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The Asteraceae of Pico Zunil.

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THE ASTERACEAE OF PICO ZUNIL

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and the

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In Partial Fulfillment

of the Requirements for the Degree

Master of Science

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by

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THESIS ACCEPTANCE

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THE ASTERACEAE OF PICO ZUNIL

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University of Nebraska, 2006

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Abstract

Forty-four genera and 93 species of native Asteraceae were collected from 2003-2005 on the northwestern slopes of Pico Zunil, a montane cloud forest habitat in southwestern Guatemala. Combining the present survey with past surveys, a total of 56 genera and 126 species of Asteraceae now have been reported from Pico Zunil, only five of which were naturalized Old World species. In the present study, the tribe Heliantheae contained the greatest number of native species (n=29) with the most diverse genus being *Ageratina* (Eupatorieae) (10 species). Species richness of native Asteraceae measured along an elevational gradient ranged from a low of 15 species at 3300-3542 m to a high of 58 species at 2300-2600 m, where human land use most actively affects cloud forest habitat.

Of the plants collected, *Ageratina rivalis* and *Verbesina sousae* were new species records for Guatemala. Six more species were new records for the Department of Quetzaltenango: *Ageratina pichinchensis, A. prunellaefolia, A. saxorum, Koanophyllon coulteri, Stevia triflora,* and *Telanthophora cobanensis*. In addition, 16 of the 97 species

collected are known to be endemic to the western montane departments of Guatemala and the montane regions of southernmost Chiapas, Mexico.

The study provides a base of information against which future studies can measure temporal changes in species' presence such as may accompany environmental changes resulting from global climate change. The study also more fully describes the occurrence of Asteraceae species in a globally threatened tropical montane cloud forest ecosystem.

Acknowledgements

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Additionally, thanks go to Dr. Michael Dillon of the Field Museum of Natural History in Chicago for his patience and support during my visits there. His expertise with the Asteraceae was crucial to my research. I also thank Christine Niezgoda for accommodating the transport of specimens to and from the Field Museum. Further, I am grateful to the entire Botany Department at the Field Museum for their open door policy and for always helping me in any way they could. I thank Dr. Harold Robinson of the Smithsonian Institute for his determinations of my Eupatorieae specimens and Dr. Billie Turner of the University of Texas for his determinations of the genus *Schistocarpha.* I

am honored to have collaborated with such distinguished members of the Asteraceae community.

My thanks also go to Dr. Frank Almeda, of the California Academy of Sciences, for introducing me to Pico Zunil and for his guidance during the writing of my thesis and to Dr. Donald Mahoney of the San Francisco Botanical Garden for allowing me to become obsessed with cloud forest plants. As a mentor and spiritual guide, Dr. Mahoney has been a major influence towards my development as a botanist.

Finally, I thank my beautiful wife, Marnie, my angelic daughter, Nomi, and my supportive and loving mother-in-law, Cindy, for all their support, tears, and smiles during my graduate program. Without their incessant love I would never have been able to accomplish all that I have. All three taught me the meaning of dedication.

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Introduction

Cloud forests, more accurately referred to as *tropical montane cloud forests* (Bruinzeel and Veneklaas, 1998; Still et al., 1999; Lawton et al., 2001), are high-elevation ecosystems with high levels of biodiversity located in the sub-tropical middle latitudes, including portions of Central and South America, Africa, and Southeast Asia (Hamilton et al., 1995). The general physiognomy of cloud forest vegetation is characterized more by its dense understory than by overstory characters or species composition, which varies considerably. In Mexico, tree ferns are perhaps the best plant indicator of cloud forest ecosystems (Leopold, 1950). In much of the tropics, cloud forests occur where mountains force trade winds to rise above the condensation level where orographic cloud formation occurs (Lawton et al., 2001). Thus, even during the dry-season, cloud forests receive water in the form of mist (low-intensity windblown precipitation) or cloud water (non-precipitating droplets deposited on vegetation) (Pounds et al., 1999).

Guatemala has the highest plant diversity of all the Central American nations with over 8000 species reported (Steyermark, 1950). Cloud forests in Guatemala, are found both in the Sierra de las Minas in the east and on the slopes of the volcanic belt where they are most prevalent on the western slopes facing the Pacific Ocean (Steyermark, 1950) (Fig. 1). The volcanic belt of Guatemala is characterized by two distinct seasons, one, the rainy season extending from May to November, being followed by the dry season that ends in mid-April. During the dry season, cloud forests are inundated daily with fog or mist.

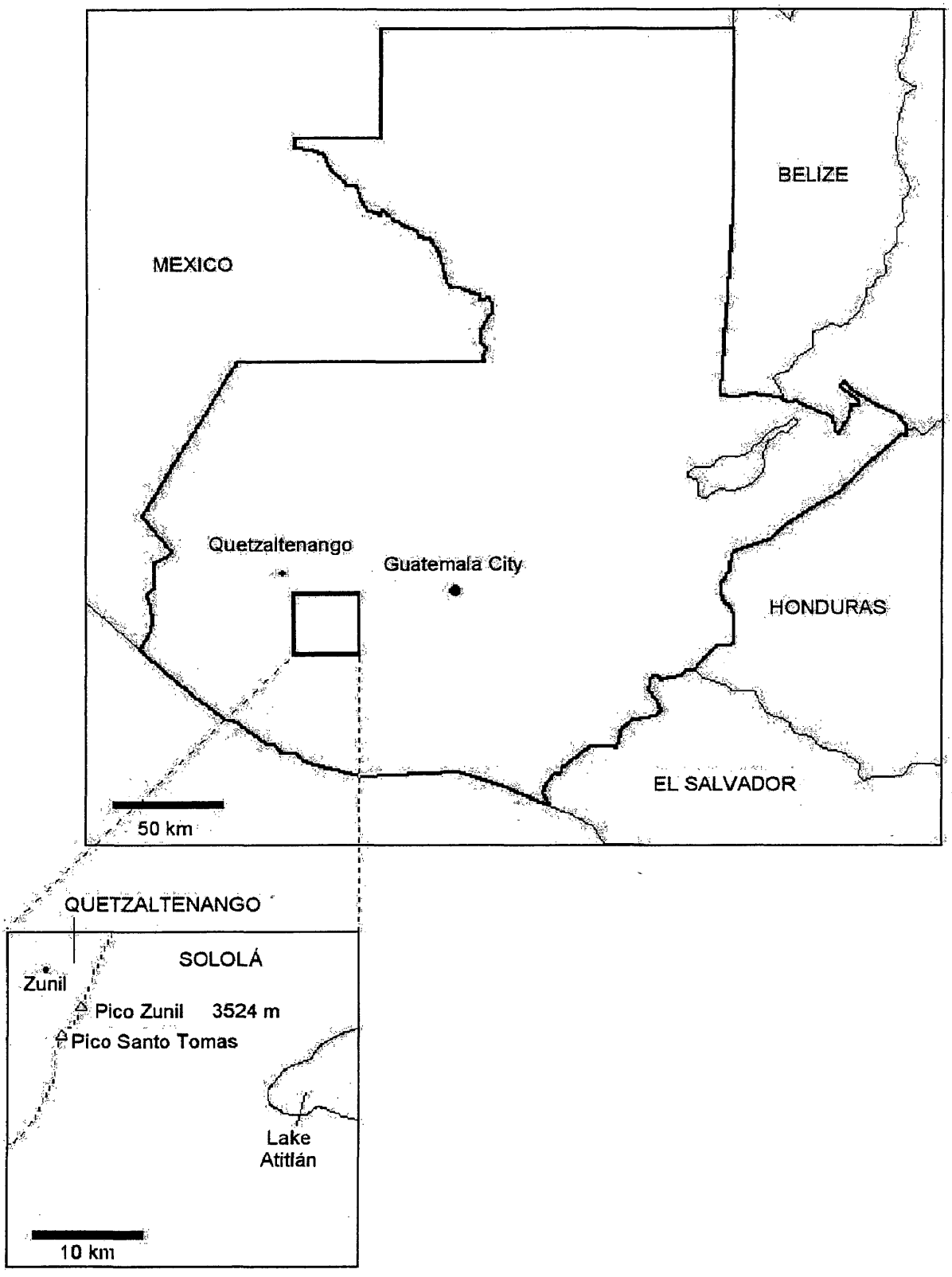

Figure 1. Study site location in Guatemala.

Geological and Botanical History

The volcanoes in western Guatemala are of Pleistocene origin (Steyermark, 1950) and many remain active, some having erupted in the recent past. Pico Zunil has been mistakenly referred to as to one of these volcanic mountains (Almeda, 1993; Anderson, 1908) but it, and the Zunil Ridge that form the Sierra Chuatroj including Pico Santo Tomas, are related to volcanic activity only in that they are derived from sloping and horizontal tertiary tuffs, lavas, and tuffaceous sediments from past volcanic activity (Williams, 1960; Gall, 1983). Fumaroles lie on fractures that cut an eroded fault scarp through the Sierra Chuatroj.

Studies on plants in the highlands of western Guatemala have been conducted since the late 1890s. For example, from 1895-1896 the naturalist Edward William Nelson made plant collections in western Guatemala, including at Pico Zunil (Breedlove, 1981). In late 1905 and early 1906, the mycologist William Ashbrook Kellerman collected plants on volcanoes adjacent to the Sierra Chuatroj including Volcán Santa Maria, Cerro Quemado, and Volcán Atitlan. Later, in 1934, the ornithologist Alexander Skutch visited Pico Zunil and recorded plants collected at that time (Nash and Williams, 1976; Skutch, 1979).

The *Flora of Guatemala* project commenced in the late 1930s under the direction of Paul Standley and Julian Steyermark of the Field Museum of Natural History in Chicago. Their work resulted in extensive collections on the volcanoes of Guatemala and throughout the country from 1939-1941, including Asteraceae collections on Pico Zunil (Nash and Williams, 1976). These collections presently are housed at the Field Museum

of Natural History in Chicago. Dennis Breedlove and Frank Almeda, of the California Academy of Sciences, visited Pico Zunil in 1986 and collected, and later described, a new tree species, *Stanmarkia spectabilis* Almeda (Melastomataceae) (Almeda, 1993). Most recently, in 1999, Mario Véliz and colleagues at the University of San Carlos in Guatemala City collected on Pico Zunil. Their collections are housed at the herbarium at the University of San Carlos (BIGU).

Cloud Forests Today

Cloud forest and humid *Pinus-Quercus* forest were once abundant in the Guatemalan highlands. Currently, however, the majority of these ecosystems are restricted to steep or remote slopes at higher elevations, including the volcanoes, because agricultural land use has lead to extensive deforestation of accessible locations (Veblen, 1978; Howell and Webb, 1995). Presently, even these tropical forest remnants, including tropical montane cloud forests of western Guatemala, are declining rapidly (Veblen, 1978; Hamilton et al., 1995). Although deforestation was occurring throughout Guatemala prior to 1930, the acceleration of extensive highland deforestation in Guatemala was first documented in the 1940s (Veblen, 1977). According to field notes observed at the Field Museum of Natural History in Chicago, Standley witnessed deforestation first-hand on the northwest slopes of Pico Zunil in January of 1941.

Climate change has been implicated as a cause for a decrease in species habitat and diversity across the planet (McCarty, 2001). For example, recent research conducted at the Monteverde Cloud Forest Preserve in Costa Rica has established a link between deforestation, climate change, and either the movement of species from lower elevations

to locations higher up the mountainsides shifting or, in some cases, the local extirpation of higher elevation cloud forest species (Pounds et al., 1999; Still et al., 1999; Lawton et al., 2001). Among other findings, research conducted at the Monteverde Cloud Forest determined that orographic cloud formation now occurs higher in the atmosphere than it once did causing the fog to pass over the mountain tops, thereby altering water availability to plant and animal species at the highest elevations (Pounds et al., 1999; Still et al., 1999; Lawton et al., 2001).

Asteraceae

The Asteraceae (Compositae) is the second largest plant family on earth, with approximately 1,535 genera and at least 23,000 species worldwide (Bremer, 1994; Pruski and Sancho, 2004). Traditionally, the Asteraceae has been divided into 17 tribes (Bremer, 1994), although current phylogenetic evidence suggests that there may be as many as 31 tribes (Panero and Funk, 2002). Growth forms within this family include annuals, biennials, and perennial herbs, vines, shrubs, trees, lianas, and a small number of epiphytes.

Pollen evidence indicates that the Asteraceae has a long evolutionary history in Central America with the family showing an explosion in diversity during the Miocene (Raven and Axelrod, 1974). In addition, topography (Kessler, 2002), geographic isolation, and optimal growth conditions led to the evolution of a particularly large number of Asteraceae species in the montane regions of Guatemala and Mexico. In Mexico, the Asteraceae has been used as a target group for conservation based on the

high number of endemic species found in that country, especially in the southern states of Chiapas and Oaxaca adjacent to Guatemala (Villaseñor et al., 1998).

In addition to being the most species-rich plant family, the Asteraceae represents one of the most conspicuous floral elements in the montane regions (Nash and Williams, 1976; Villaseñor et. al 1998; Strother, 1999; Kessler, 2002) and one whose species' distribution are associated with elevation. For example, in the Bolivian Andes, the Asteraceae, while found to be distributed at all elevations, had its highest values of species richness and endemism from 2000-3000 m (Kessler, 2002).

Eleven tribes of Asteraceae were collected by the *Flora of Guatemala* project, all of which have representatives in the montane regions, and many of which are endemic (Nash and Williams, 1976). The volcanic belt in western Guatemala was found to be especially high in Asteraceae diversity with the greatest number of species occurring in Eupatorieae, Heliantheae, and Senecioneae (Nash and Williams, 1976; Véliz Pérez et al., 2001). The flora of Guatemala has a noticeable southern Mexican influence with most of the genera found in Guatemala also found in Mexico (Steyermark, 1950).

The Asteraceae has been extensively collected in the highlands of western Guatemala, but a floristic survey specifically of the Asteraceae has not been conducted on Pico Zunil. My study was conducted primarily to fill this gap.

Methodology

Site Description

The study was conducted at Pico Zunil (14° 46' N; 91° 27' W), a mountain with a peak elevation of 3,542 meters (Williams, 1960; Gall, 1983). Pico Zunil is part of the Sierra Chuatroj range formed by the Zunil ridge that extends from south to north perpendicular to the Pacific coast between the departments of Quetzaltenango and Sololá (Fig. 1). The Sierra Chuatroj, located between Rio Samalá to the west and Rio Nahualá to the east, is part of a volcanic belt that extends 120 km from south of Guatemala City to the Mexican border. At 2800 m, the annual temperature of the highland regions of western Guatemala averages annual temperature of 11°C with 130-250 centimeters of annual precipitation (Véliz Pérez et al., 2001). Climate data specifically from 1700 m elevation on Volcán Acatenango, located 68 kilometers southeast of Pico Zunil, indicates an average annual temperature of 18°C (Véliz Pérez, 2000). During the dry season between late November and April, there is a daily influx of fog from the Pacific Ocean that shrouds Pico Zunil in mist.

Methods

I focused my collections on the Asteraceae because they are a morphologically diverse group filling many ecological niches. The study site, Pico Zunil, was selected because the northwestern slopes support cloud forest habitat, are accessible, and have previously been reported to be rich in Asteraceae diversity (Nash and Williams, 1976). In preparation for field collecting and comparative analysis, I surveyed the Asteraceae

specimens located at the Field Museum of Natural History in Chicago focusing on those collected for the *Flora of Guatemala* project (Nash and Williams, 1976). Specifically, I looked for specimens collected at and above 1300 meters in the departments of Quetzaltenango and Sololá, species most likely to be found at Pico Zunil.

Field collections of Asteraceae on Pico Zunil were made in December 2003, January, May, and December, 2004, and January and May, 2005, dates when most of the Asteraceae were flowering. I collected along roadsides and trails and up to 100 m off trails on the northwestern slopes of Pico Zunil. Northwestern slopes were selected because they were more accessible than other slopes and because they supported a greater number of habitats. Collections were also made on the peak and to the southwest of the peak along the ridge between Pico Zunil and Pico Santo Tomas. At each collection site, habitat and site information were collected including dominant tree species, GPS coordinates, and elevation. Woody species and herbs other than Asteraceae were collected, identified at the University of San Carlos, and deposited at the herbarium in Guatemala City (BIGU).

Sampling locations were separated into five elevational bands. The first elevational band, located between 2000 and 2299 meters, consisted of dense forest with rocky outcrops. It included the hot springs at Aguas Amargas, the road leading up to the hot springs, and trails at and above the hot springs. The second elevational band was located between 2300 and 2599 meters and consisted of dense forest with rocky outcrops and sulfur fumaroles. This band included the hot springs at Fuentes Georginas, the road leading up to the hot springs, and trails at and above the hot springs. It also included the dirt road above the small Mayan community known as Aldea Chuimucubal. Significant

habitat loss due to human land use is prevalent at this elevational band. The third elevational band was located between 2600 and 2999 meters and consisted of dense forest with only a few rocky outcrops. The fourth elevational band, located between 3000 and 3299 meters, consisted of dense forest, open meadows, and rocky outcrops. The fifth elevational band, located between 3301 and the peak at 3542 meters, consisted of elfin forest and frost woodland (Beard, 1944) with rocky outcrops and sparsely distributed, stunted trees.

Collections were partially dried in the field and then transported to the herbarium at the University of San Carlos in Guatemala City where they were completely dried and fumigated to control insect and fungal growth. Specimens were tentatively identified in Guatemala and then exported to the University of Nebraska at Omaha and the Field Museum of Natural History in Chicago for further identification. In Chicago, Michael Dillon assisted with specimen identification.

The systematics of many of the genera collected are still being resolved. For example, considerable molecular research is required to elucidate relationships among genera such as *Ageratina, Archibaccharis, Baccharis, Bartlettina, Gnaphalium, Hymenostephium, Roldana, Schistocarpha, Stevia,* and *Vernonia* (Bremer, 1994). Also, the Eupatorieae (King and Robinson, 1987) and Senecioneae (Robinson and Brettell, 1975; Barkley, 1985; Barkley et al., 1996) require a complete monographic revision incorporating molecular analysis because the evolutionary relationships within these groups have only been addressed morphologically. The genera *Stevia* and *Eupatorium sensu lato* were especially difficult to key using the *Flora of Guatemala* (Nash and Williams, 1976) because many of the floral and vegetative characters were not stated

clearly in the manuscript. Because of the expertise required to identify particularly complex taxa, all specimens of the tribe Eupatorieae were sent to Harold Robinson of the Smithsonian Institution in Washington, D.C. for his determinations. Similarly, specimens of *Schistocarpha* were sent to Billie Turner of the University of Texas at Austin for verification.

A full set of specimens was deposited at the University of San Carlos of Guatemala Biology Herbarium (BIGU). Subsets of my collections were deposited at the California Academy of Sciences (CAS), the Field Museum of Natural History in Chicago (F), the Missouri Botanical Garden (MO), the New York Botanical Garden (NY), the Smithsonian Institution (US), the University of Texas at Austin (TEX), and the University of Nebraska at Omaha (OMA). Distribution of voucher specimens is indicated in the annotated checklist.

Analysis

Native species of Asteraceae on Pico Zunil were listed both by elevation and as a comparison to previous collections based on vouchers observed at the Field Museum of Natural History. The majority of the vouchers examined were collected by Paul Standley and Julian Steyermark for the *Flora of Guatemala* project, which also included vouchers from all other collections made in Guatemala. By comparing my collection with past collections I was able to infer changes in species richness of Asteraceae over time. Elevation data were not accurately represented in past collections, thus a comparison by elevation was not possible. Differences in collecting procedures between the present and past studies further complicated inferences about temporal change.

Results

Collections: 1895-2005

Forty-seven genera and 97 species of native Asteraceae were collected during four research visits to Pico Zunil from 2003-2005 resulting in two new species records for Guatemala and nine new records for the Department of Quetzaltenango (Table 1). Five of the Asteraceae collected were introduced species from the Old World that have become naturalized throughout North America: *Cotula australis, Hypochaeris glabra, Senecio vulgaris, Sonchus oleraceus,* and *Taraxacum officinale* (Table 2). These results compare to 43 genera and 73 species of native Asteraceae recorded from vouchers reported from Pico Zunil for the *Flora of Guatemala* project (Nash and Willliams, 1976) (Table 2).

Elevational Distribution

Asteraceae species distribution differed by elevation (Table 1). Based on vouchers collected for my study and personal observations in the field the principal Asteraceae from 2000-2299 m were *Ageratum rugosum, Alloispermum integrifolium, Fleischmannia pycnocephaloides, Montanoa pteropoda, Piptothrix areolaris, Tagetes sororia,* and *Vernonia arborescens.* Principal trees of this elevational band included *Billia hippocastanum, Bocconia arborea, Leandra subseriata, Oreopanax xalapensis, Podachaenium eminens, Urera caracasana,* and *Wigandia urens* and shrubs included *Justicia aurea* f. *erythrina, Monochaetum subtriplinervium,* and *Tibouchina longisepala.*

Table 1. Elevational distribution of native Asteraceae on the northwestern slope and peak of Pico Zunil. Old World naturalized species are not included.

Species	Elevation (meters)				
	2000-2299	2300-2699	2700-2999	3000-3399	3400-3542
SPECIES RICHNESS	28	58	28	34	15
TAXA					
Ageratina helenae	X	X			
Ageratum rugosum	X	X			
Alloispermum integrifolium	X	X			
Baccharis serraefolia	X				
Baccharis trinervis	X				
Bidens squarrosa	X	X			
Conyza canadensis	X				
Coreopsis mutica var. *microcephala*	X				
Dahlia imperialis	X	X		X	
Erechtites valerianaefolia	X	X			
Erigeron karvinskianus	X	X			
Fleischmannia pycnocephaloides	X	X	X	X	
Galinsoga cilata	X	X			
Gnaphalium brachyphyllum[1]	X	X			X
Hymenostephium cordatum	X	X			
Koanophyllon coulteri[2]	X				
Montanoa pteropoda[1]	X	X	X		
Peteravenia phoenicolepis	X				
Peteravenia schultzii	X				
Piptothrix areolaris	X	X			
Polymnia maculata var. *maculata*	X				
Rojasianthe superba[1]	X	X	X		
Salmea scandens	X	X			
Simsia amplexicaulis	X				
Stevia lucida var. *oaxacana*	X				
Tagetes sororia	X	X			
Tithonia longiradiata	X				
Verbesina sublobata	X				
Acmella repens var. *beccabunga*		X			
Ageratina mairetiana		X	X		
Ageratina prunellaefolia[2]		X			
Ageratina saxorum[1]		X			
Alepidocline annua		X			
Ageratina subinclusa		X		X	
Archibaccharis asperifolia		X			

Table 1. Elevational distribution of native Asteraceae on the northwestern slope and peak of Pico Zunil. Old World naturalized species are not included.

Species	Elevation (meters)				
	2000-2299	2300-2699	2700-2999	3000-3399	3400-3542
Archibaccharis blakeana		X			
Archibaccharis flexilis		X			
Archibaccharis schiedeana		X			
Baccharis salicifolius		X			
Bartlettina ornata[1]		X			
Bidens bicolor		X	X		
Bidens chrysanthemifolia		X	X	X	
Bidens holwayi[1]		X	X	X	
Clibadium arboreum		X			
Conyza apurensis		X	X		
Conyza bonariensis		X			X
Gamochaeta americana		X			
Gnaphalium salicifolium		X		X	
Gnaphalium semiamplexicaule		X	X	X	
Gnaphalium viscosum		X			
Hieracium irazuense		X			X
Jaegeria hirta		X			
Montanoa guatemalensis		X			
Podachaenium eminens		X			
Polymnia maculata var. *adenotricha*		X			
Roldana gilgii[1]		X	X	X	
Roldana heterogama		X		X	X
Roldana jurgensenii		X		X	
Sabazia pinetorum[1]		X			
Schistocarpha platyphylla		X		X	
Senecio doratophyllus		X	X		
Sigesbeckia jorullensis		X		X	
Stevia polycephala		X		X	X
Stevia triflora[2]		X	X		
Telanthophora cobanensis[2]		X	X		
Telanthophora grandifolia var. *grandifolia*		X			
Verbesina aplcura[1]		X	X	X	
Verbesina holwayi[1]		X	X		
Verbesina hypoglauca		X		X	X
Vernonia arborescens		X			
Ageratina rivalis[2,3]			X	X	X
Baccharis vaccinioides			X	X	X
Gnaphalium greenmanii			X		
Gnaphalium liebmanii var. *monticola*			X	X	X
Roldana acutangula[1]			X		X

Table 1. Elevational distribution of native Asteraceae on the northwestern slope and peak of Pico Zunil. Old World naturalized species are not included.

Species	Elevation (meters)				
	2000-2299	2300-2699	2700-2999	3000-3399	3400-3542
Roldana aschenborniana			X	X	
Senecio godmanii			X	X	
Senecio rhyacophilus[1,2]			X	X	X
Senecio warszewiczii[1]			X	X	X
Stevia incognita			X		
Stevia jorullensis			X		
Tagetes foetidissima			X		
Verbesina sousae[2,3]			X		
Ageratina caeciliae[1]				X	
Ageratina pichinchensis				X	
Ageratina zuniliana[1]				X	
Archibaccharis corymbosa[1]				X	
Cirsium subcoriaceum				X	
Cosmos caudatus[2]				X	
Dahlia australis				X	
Oxylobus glanduliferus				X	X
Roldana barba-johannis				X	
Senecio callosus				X	
Stevia microchaeta				X	
Tridax procumbens				X	
Bidens triplinervia					X
Osbertia stolonifera					X

[1] species endemic to the highlands of western Guatemala and southern Chiapas, Mexico.
[2] new department records for Quetzaltenango.
[3] new country records for Guatemala.

Table 2. Present and past collections of Asteraceae on Pico Zunil based on recent and past collections, including naturalized Old World species.

Species	Collection Dates	
	Present Study (2003-2005)	Past Studies[1]
SPECIES RICHNESS	102	73
Acmella filipes var. *parvifolia*		X
Acmella repens var. *beccabunga*	X	X
Ageratina caeciliae	X	
Ageratina helenae	X	X
Ageratina mairetiana	X	
Ageratina pazcuarensis	X	X
Ageratina pichinchensis	X	
Ageratina prunellaefolia	X	
Ageratina rivalis	X	
Ageratina saxorum	X	
Ageratina subinclusa	X	
Ageratina zuniliana	X	X
Ageratum rugosum	X	
Alepidocline annua	X	X
Alloispermum integrifolium	X	X
Archibaccharis asperifolia	X	
Archibaccharis blakeana	X	X
Archibaccharis corymbosa	X	
Archibaccharis flexilis	X	
Archibaccharis schiedeana	X	
Baccharis serraëfolia	X	
Baccharis trinervis	X	
Baccharis salicifolius	X	
Baccharis vaccinioides	X	
Barkleyanthus salicifolius		X
Bartlettina luxii		X
Bartlettina ornata	X	
Bartlettina pinabatensis		X
Bidens bicolor	X	
Bidens chrysanthemifolia	X	X
Bidens holwayi	X	X

Table 2. Present and past collections of Asteraceae on Pico Zunil based on recent and past collections, including naturalized Old World species.

Species	Collection Dates	
	Present Study (2003-2005)	Past Studies[1]
Bidens odorata		X
Bidens ostruthioides		X
Bidens squarrosa	X	
Bidens triplinervia	X	X
Cirsium radicans		X
Cirsium subcoriaceum	X	X
Clibadium arboreum	X	X
Conyza apurensis	X	
Conyza bonariensis	X	
Conyza canadensis	X	X
Conyza coronopifolia		X
Conyza sophiifolia		X
Coreopsis mutica var. *microcephala*	X	X
Cosmos caudatus	X	
Cotula australis	X	
Critoniadelphus nubigenus		X
Dahlia australis	X	
Dahlia imperialis	X	X
Erechtites valerianaefolia	X	
Erigeron karvinskianus	X	X
Fleishmannia pycnocephaloides	X	X
Galinsoga ciliata	X	
Gamochaeta americana	X	
Gamochaeta pensylvanica		X
Gamochaeta purpurea		X
Gnaphalium brachyphyllum	X	X
Gnaphalium brachypterum		X
Gnaphalium greenmanii	X	
Gnaphalium liebmanii var. *monticola*	X	
Gnaphalium salicifolium	X	
Gnaphlaium semiamplexicaule	X	X
Gnaphalium viscosum	X	
Hieracium guatemalense		X
Hieracium irazuense	X	
Hymenostephium cordatum	X	X
Hypochaeris glabra[2]	X	
Jaegeria hirta	X	X
Koanophyllon coulteri	X	

Table 2. Present and past collections of Asteraceae on Pico Zunil based on recent and past collections, including naturalized Old World species.

Species	Collection Dates	
	Present Study (2003-2005)	Past Studies[1]
Montanoa guatemalensis	X	
Montanoa pteropoda	X	X
Neomirandea araliifolia		X
Osbertia stolonifera	X	
Oteiza raucophila		X
Oxylobus glanduliferus	X	
Peteravenia phoenicolepis	X	X
Peteravenia schultzii	X	X
Piptothrix areolaris	X	X
Podachaenium eminens	X	X
Polymia maculate	X	X
Rojasianthe superba	X	X
Roldana acutangula	X	X
Roldana aschenborniana	X	
Roldana barba-johannis	X	X
Roldana gilgii	X	X
Roldana heterogama	X	X
Roldana jurgensenii	X	X
Sabazia pinetorum	X	
Salmea scandens	X	X
Schistocarpha platyphylla	X	X
Senecio callosus	X	
Senecio doratophyllus	X	X
Senecio godmanii	X	X
Senecio rhyacophilus	X	
Senecio vulgaris[2]	X	
Senecio warszewiczii	X	X
Sigesbeckia jorullensis	X	X
Simsia amplexicaulis	X	X
Sinclairia discolor		X
Sinclairia sublobata		X
Sonchus oleraceus[2]	X	X
Squamopappus skutchii		X
Stevia incognita	X	
Stevia jorullensis	X	
Stevia lucida var. *oaxacana*	X	X

Table 2. Present and past collections of Asteraceae on Pico Zunil based on recent and past collections, including naturalized Old World species.

Species	Collection Dates	
	Present Study (2003-2005)	Past Studies[1]
Stevia microchaeta	X	
Stevia ovata var. *ovata*		X
Stevia polycephala	X	X
Stevia triflora	X	
Tagetes foetidissima	X	
Tagetes sororia	X	X
Tagetes tenuifolia		X
Taraxacum officinale[2]	X	X
Telanthophora cobanensis	X	
Telanthophora grandifolia var. *grandifolia*	X	
Tithonia longiradiata		X
Tridax procumbens	X	
Trixis inula		X
Verbesina apleura	X	
Verbesina holwayi	X	
Verbesina hypoglauca	X	X
Verbesina sousae	X	
Verbesina sublobata	X	X
Vernonia arborescens	X	X
Vernonia leiocarpa		X
Vernonia salvinae		X

[1] Past studies = Specimens collected prior to 1960 and examined by Nash and Williams for the *Flora of Guatemala* project at the Field Museum of Natural History herbarium (F).
[2] Naturalized, old world species.

Common herbs were represented by *Heterocentron subtriplinervium, Nasa triphylla* ssp. *rudis,* and *Salvia purpurea.*

From 2300-2699 m, dominant Asteraceae included *Alloispermum integrifolium, Bidens chrysanthemifolia, B. holwayi, Dahlia imperialis, Fleischmannia pycnocephaloides, Montanoa pteropoda, Piptothrix areolaris, Podachaenium eminens, Rojasianthe superba, Roldana gilgii, Sigesbeckia jorullensis,* and *Verbesina apleura.* At this elevational band, predominant tree species shifted to *Alnus acuminata, Billia hippocastanum, Bocconia arborea, Carpinus carolianus* var. *tropicalis, Chiranthodendron pentadactylon, Fucshia arborescens, Leandra subseriata, Miconia tacanensis, Oreopanax xalapensis, Pinus ayacahuite, Rondoletia cordata, Saurauria oreophila, S. subalpina, Stanmarkia spectabilis,* and *Wigandia urens.* Predominant shrubs of this elevation were *Coriaria thymifolia, Gaultheria odorata, Monochaetum deppeanum, Rondoletia strigosa,* and *Tibouchina longisepala* with herbs represented by *Lobelia laxiflora, Passiflora membranacea, Salvia holwayi,* and *S. purpurea.*

From 2700-2999 m, abundant Asteraceae included *Baccharis vaccinioides, Bidens holwayi, Fleischmannia pycnocephaloides, Montanoa pteropoda, Rojasianthe superba, Roldana gilgii,* and *Verbesina apleura.* At this elevation, trees were primarily *Alnus acuminata, Chiranthodendron pentadoctylon, Cupressus lusitanica, Fucshia arborescens,* and *Saurauria subalpina* with shrubs predominantly represented by *Fucshia splendens, Lycianthes quichensis,* and *Philadelphus myrtioides.* Common herbs were represented by *Crusea coccinea, Eryngium cymosum,* and *Valeriana clematitis.*

From 3000-3399 m, dominant Asteraceae included *Archibaccharis corymbosa, Baccharis vaccinioides, Senecio rhyacophilus, S. warszewiczii, Stevia polycephala,* and

Verbesina hypoglauca with tree species primarily *Abies guatemalensis, Alnus acuminata, Arbutus xalapensis, Bocconia vulcanica, Cupressus lusitanica,* and *Oreopanax echinops.* Shrubs were represented by *Ceanothus caeruleus, Lycianthes quichensis,* and *Rubus trilobus* with common herbs represented by *Acaena elongata, Arracacia atropurpurea, A. donnell-smithii, Bomarea acutifolia, Castilleja integrifolia, Cunila polyantha, Lobelia aguana,* and *Lupinus montanus.*

From 3400 m to the peak at 3542 m, dominant Asteraceae included *Baccharis vaccinioides*, *Bidens triplinervia, Osbertia stolonifera, Oxylobus glanduliferus, Senecio warszewiczii,* and *Stevia polycephala.* At this highest elevational band, tree species shifted to *Alnus firmifolia, Buddleja megalocephala,* and *Pinus hartwegii.* Shrubs included *Berberis vulcanica, Holodiscus argenteus, Pernettya ciliata,* and *Symphoricarpos microphyllus* with herbs represented by *Castilleja integrifolia, Penstemon gentianoides, Polystichum speciosissimum,* and *Stipa ichu.*

Annotated Checklist

With this study, a total of 56 genera and 126 species of Asteraceae have been reported from Pico Zunil (Table 2). These species are treated in the following annotated checklist which includes specimens from both the recent field collections of Asteraceae made for this study and past collection vouchers of Asteraceae examined at the Field Museum in Chicago. Specimen vouchers from the Field Museum of Natural History collected on Pico Santo Tomas, the peak 2 km south of Pico Zunil, are included because of the proximity of this peak to the study site.

The Annotated Checklist briefly describes the specimens of Asteraceae collected on Pico Zunil ordering them alphabetically by tribe and genera within each tribe. Synonyms are provided. The x^3TROPICOS website (Solomon, 1996) and the *Flora of Guatemala (Asteraceae)* (Nash and Williams, 1976) were used to provide the most current species nomenclature and citations. There have been many nomenclatural changes to the Asteraceae since completion of the Asteraceae treatment for the Flora of Guatemala thus it was difficult to provide accurate and current names for all taxa, especially the Eupatorieae.

Collection numbers are mine unless otherwise indicated. The location of the specimens as of August, 2006 is given. Acronyms for herbaria follow the Index Herbariorum (Holmgren and Keuken, 1974): The Field Museum of Natural History in Chicago (F), the Missouri Botanical Garden (MO), the New York Botanical Garden (NY), the Smithsonian Institution (US), the University of Nebraska at Omaha (OMA), the University of San Carlos of Guatemala Biology Herbarium (BIGU), and the University of Texas at Austin (TEX). In the checklist, the numbers within brackets [ ]

indicate to the elevation band in meters at which specimens were collected. The elevation indicated is based either on the elevation where I collected specimens or, for specimens examined at the Field Museum of Natural History, those with sufficiently accurate label information.

The brief description and distribution of each species in the annotated checklist is based primarily on Nash and Williams (1976), the x^3TROPICOS website (Solomon, 1996), Strother (1999), or Dillon et al. (2000). Species listed as endemic are those taxa restricted to the highland departments of western Guatemala and the southern highlands of Chiapas, Mexico. The departments of Guatemala are listed in alphabetical order and the countries of Latin America are listed from north to south. Old World distributions are not included. Where known, type specimen citations are provided for taxa from Guatemala.

Tribe: Anthemideae

The Anthemidae, one of the most easily recognized tribes, contains 109 genera and approximately 1740 species (Bremer, 1994). This tribe is distributed mostly throughout temperate and arctic regions. Only one naturalized species from this tribe is reported from Pico Zunil.

Cotula australis (Sieber *ex* Spreng.) Hook. f. Fl. Nov.-Zel. 1: 128. 1853. Synonym: *Cotula villosa* DC. Prodr. 6: 79. 1837.

Material seen — [2300-2699] — *761* (BIGU, F), *1698* (BIGU, TEX).

Annual Old World herbs naturalized throughout North and South America

Distribution — United States, Mexico, Argentina, Bolivia, Colombia, Ecuador, Peru. Native to Pacific Islands, New Zealand, and Australia.

Tribe: Astereae

The Astereae is the second most species-rich tribe worldwide with approximately 170 genera and 3000 species (Bremer, 1994). This tribe is most abundant in northern temperate regions, although *Baccharis* and *Archibaccharis* form a major part of the floral element in the Guatemalan highlands. *Baccharis vaccinioides* is perhaps the most ubiquitous shrub or small tree on the high mountains in Guatemala and was collected more than any other species of Asteraceae during this study. The genera *Baccharis* and *Conyza* contain several weedy species that may be good indicators of anthropogenic disturbance.

Archibaccharis asperifolia (Benth.) Blake Contr. U. S. Nat. Herb. 23: 1509. 1926

Material seen — [2300-2699] — *1681* (BIGU, F).

Erect plants to 2 m, common in pine-oak forest.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Guatemala, Huehuetenango, Progreso, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá, Suchitepéquez, Totonicapán, Zacapa. Central Mexico, Honduras, northern Nicaragua.

Archibaccharis blakeana Standl. & Steyerm. Publ. Field Mus. Nat. Hist., Bot. Ser. 22: 296. 1940.

Material seen — [2300-2699] — *512* (BIGU, F); *L. Williams, A. Molina R., T. Williams*

22998 (F).

Arching shrubs to 3 m common in pine forest.

Distribution — Chimaltenango, Guatemala, Quetzaltenango, Sacatepéquez. Chiapas, Mexico.

Type — Collected near Antigua, Sacatepéquez, *Standley 58597* (F).

Archibaccharis corymbosa (Donn. Sm.) Blake J. Wash. Acad. Sci. 17: 60. 1927. Synonym: *Diplostephium corymbosum* Donn. Sm. Bot. Gaz. 23(1): 8. 1897.

Material seen — [3000-3399] — *2510* (BIGU, F), *2590* (BIGU, OMA). Pico Santo Tomas, *Steyermark 34809* (F).

Erect or arching shrubs to 3 m with purple flowers.

Distribution — Chimaltenango, Huehuetenango, Quetzaltenango, Sacatepéquez, San Marcos, Totonicapán. Chiapas, Mexico. Endemic.

Type — From Todos Santos, Huehuetenango, *E. W. Nelson 3639* (US).

Archibaccharis flexilis Blake J. Wash. Acad. Sci. 17: 60. 1927.

Material seen — [2300-2699] — *1855* (BIGU, F).

Arching shrubs or woody vines often climbing in trees.

Distribution — Alta Verapaz, Chimaltenango, Quetzaltenango, Sacatepéquez, San Marcos, Sololá, Suchitepéquez, Totonicapán. Mexico, El Salvador, Honduras, Nicaragua, Costa Rica.

Type — Collected at Cobán, Alta Verapaz; alt. 1350 m, March 1908, *H. von Tuerckheim II 1636* (US).

Archibaccharis schiedeana (Benth. *in* Oerst.) J. D. Jackson Phytologia 28: 297. 1974. Synonym: *Baccharis shiedeana* Benth. *in* Oerst Vidensk. Meddel. Dansk Naturhist. Foren. Kjobenhavn 1852: 83. 1852.

Material seen — [2300-2699] — *1715* (BIGU, F, TEX); *1692* (BIGU, TEX).

Scrambling shrubs with purple flowers.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Chiquimula, Guatemala, Huehuetenango, Jalapa, Jutiapa, Quetzaltenango, Quiché, Sacatepéquez, Santa Rosa. Southern Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama.

Baccharis salicifolia (Ruiz & Pav.) Pers. Syn. Pl. 2: 425. 1807.

Material seen — [2300-2699] — *1838* (BIGU, F).

Abundant shrubs to 5 m common along waterways.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Chiquimula, Escuintla, Guatemala, Huehuetenango, Izabal, Jalapa, Jutiapa, Progreso, Quetzaltenango, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Zacapa. Southwestern United States, Mexico, Belize, El Salvador, Honduras, Nicaragua, South America.

Baccharis serraefolia DC. Prodr. 5: 403. 1836.

Material seen — [2000-2299] — *1773* (BIGU, F); *L. O. Williams 14308* (F).

Erect shrubs or suffrutescent herbs to 2 m.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Escuintla, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá, Totonicapán. Southern Mexico, El Salvador, Honduras, Nicaragua.

Baccharis trinervis (Lam.) Pers. Syn. Pl. 2: 423. 1807.

Material seen — [2000-2299] — *1883* (BIGU, F).

Dense shrubs to 3 m, frequently with arching branches.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Escuintla, Guatemala, Huehuetenango, Izabal, Jalapa, Jutiapa, Petén, Quetzaltenango, Quiché, Sacatepéquez, Santa Rosa, Sololá, Suchitepéquez, Zacapa. Central Mexico, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, tropical South America.

Baccharis vaccinioides Kunth Nov. Gen. Sp. (folio ed.) 4: 39-40. 1820.

Material seen — [2000-2299, 2700-2999, 3000-3399, 3400-3542] — *646* (BIGU, F); *2614* (BIGU, OMA); *581, 775, 1834, 2580* (BIGU, TEX); *Standley 83242* (F).

Common shrubs or trees to 7 m throughout the highlands of Guatemala.

Distribution — Chimaltenango, Guatemala, Huehuetenango, Jalapa, Progreso, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá, Totonicapán, Zacapa. Chiapas, Mexico, El Salvador, Honduras.

Conyza apurensis Kunth Nov. Gen. Sp. (folio ed.) 4: 73. 1820.

Material seen [2300-2699, 2700-2999] — *770* (BIGU, OMA, TEX); *776* (BIGU, F, MO); *1790* (BIGU, TEX).

Erect annuals to 1 m.

Distribution — Alta Verapaz, Guatemala, Izabal, Jalapa, Jutiapa, Petén, Progreso, Quetzaltenango, Quiché, Retalhuleu, Sacatepéquez, Santa Rosa, Totonicapán, Zacapa. Mexico, Belize, El Salvador, Honduras, Nicaragua, Panama, Ecuador, Peru, Venezuela. West Indies.

Conyza bonariensis (L.) Cronquist Bull. Torr. Bot. Club 70: 632. 1943.

Material seen — [2300-2699, 3400-3542] — *677* (BIGU, OMA); *707* (BIGU, F); *764, 2537* (BIGU, TEX).

Erect annuals to 2 m. A pantropical weed.

Distribution — Southern United States, Mexico, Central and South America.

Conyza canadensis (L.) Cronquist Bull. Torr. Bot. Club 70: 632. 1943.

Material seen — [2000-2299] — *1747* (BIGU, F); *Standley 83245* (F); *Steyermark 34995* (F).

Errect annuals to 2 m common along roadsides and in open fields.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Guatemala, Huehuetenango, Izabal, Jalapa, Petén, Quetzaltenango, Sacatepéquez, San Marcos, Santa Rosa, Sololá. United States, Mexico, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, Panama. South America, Caribbean.

Conyza coronopifolia Kunth Nov. Gen. Sp. (folio ed.) 4: 70. 1820.

Material seen — [2000-2299] — *Standley 83187* (F).

Erect or ascending annuals or perennials to 75 cm.

Distribution — Alta Verapaz, Chimaltenango, Guatemala, Huehuetenango, Quetzaltenango, Quiché, San Marcos, Sololá. Central and southern Mexico, El Salvador, Honduras, Costa Rica, Ecuador, Argentina.

Conyza sophiifolia Kunth Nov. Gen. Sp. (folio ed.) 4: 56, t. 326. 1820. Synonym: *Laennecia sophiifolia* (Kunth) Nesom Phytologia 68(3): 225. 1990.

Material seen — [2000-2299, 2300-2699] — *Standley 67309, 83217, 83923* (F); *Steyermark 34470* (F).

Erect annuals to 1 m often much-branched.

Distribution — Chimaltenango, Chiquimula, Guatemala, Huehuetenango, Jalapa, Progreso, Quetzaltenango, Sacatepéquez, San Marcos, Sololá, Totonicapán. Southwestern United States, Mexico, El Salvador, Honduras, Colombia, Bolivia, Ecuador, Argentina.

Erigeron karvinskianus DC. Prodr. 5: 285. 1836. Synonym: *Erigeron pacayensis* Greenm. Publ. Field Mus. Nat. Hist., Bot. Ser. 2: 266. 1907.

Material seen — [2000-2299, 2300-2699] — *543* (BIGU, CAS, F, NY); *621* (BIGU, TEX); *1690* (BIGU, MO, TEX); *1768* (BIGU, OMA); *Standley 83169, 83925, 85767* (F); *Steyermark 34486* (F).

A pantropical weed that is one of the most common small plants of the mountains of Guatemala.

Distribution — Chimaltenango, Chiquimula, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Retalhuleu, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Suchitepéquez, Totonicapán. Mexico, El Salvador, Honduras, Nicaragua. South America, Caribbean.

Osbertia stolonifera (DC.) Greene Erythrea 3: 14. 1895. Synonym: *Haplopappus stoloniferus* DC. Prodr. 5: 349. 1836

Material seen — [3400-3542] — *711* (F, BIGU).

Stoloniferous perennials with yellow ray and orange disc flowers common on rocky outcrops at the peak.

Distribution — Chimaltenango, Huehuetenango, Quetzaltenango, San Marcos, Sacatepéquez, Sololá, Totonicapán. Central and southern Mexico.

Tribe: Carduceae

Formerly the Cynareae, this tribe contains the thistles. Worldwide, the Carduceae is a large group with 83 genera and 2500 species (Bremer, 1994). Only the genus *Cirsium* is present in Guatemala where all species are biennials.

Cirsium radians Benth. Pl. Hartw. 77. 1841.

Material seen — [2300-2699] — *Standley 85947, 85764* (F).

Herbs to 1.5 m with lavender corollas, common in meadows and fields.

Distribution — Alta Verapaz, Chimaltenango, Huehuetenango, Quetzaltenango, San Marcos, Totonicapán. Endemic to the western highlands of Guatemala.

Type — From Quetzaltenango, *Hartweg 538* (B).

Cirsium subcoriaceum (Less.) Sch. Bip. Bot. Voy. Herald 312. 1856.

Material seen — [2300-2699, 3000-3399, 3400-3542] — *582* (BIGU, F); *2568* (BIGU, TEX); *Standley 83316, 85737* (F).

Herbs to 2.5 m with rose-purple corollas.

Distribution — Alta Verapaz, Chimaltenango, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Totonicapán, Zacapa. Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama.

Tribe: Eupatorieae

The Eupatorieae is represented by 170 genera and approximately 2400 species worldwide. This tribe accounts for 10% of the species in the Asteraceae and one of every 150 flowering plants, including a major portion of the Asteraceae in the Neotropics (King and Robinson, 1987). In Latin America, the Eupatorieae is represented by annual and perennial herbs, vines, shrubs, and small trees. In Guatemala, members of this tribe occur in numerous habitats, although most are found at elevations above 1800 m where a definite wet-dry climate regimen occurs. One hundred forty-one species of Eupatorieae were reported from Guatemala prior to this study (Nash and Williams, 1976). Harold Robinson of the Smithsonian Institution determined my collections of the Eupatorieae.

Eupatorium sensu lato, a large genus with over 600 species worldwide, is concentrated in the Neotropics (Nash and Williams, 1976). Recently *Eupatorium* has been segregated into numerous smaller genera by King and Robinson (1987). The most common genus in Guatemala, *Ageratina,* is the largest and most diverse genus in the subtribe Oxylobinae (King and Robinson, 1987). The Eupatorieae is still poorly understood in Latin America and requires a thorough monographic revision.

Ageratina caeciliae (B. L. Rob.) King & H. Rob. Phytologia 19(4): 220. 1970. Synonym: *Eupatorium caeciliae* B. L. Rob. Contr. Gray Herb. 90: 23-24. 1930.

Material seen — [2700-2999] — *2612A* (BIGU, MO, TEX, US). Pico Santo Tomas, *Steyermark 34823* (F).

Attractive shrubs to small trees 2-5 m tall with pink corollas and coriaceous leaves.

Distribution — Endemic in montane cloud forests of Chimaltenango, Quetzaltenango, Sololá, Totonicapán. Chiapas, Mexico.

Type — Mountains above Totonicapán, *Standley 84404* (F).

Ageratina helenae King & H. Rob. Phytologia 24(2): 90-91. 1972. Synonym: *Eupatorium capillipes* Benth. Vidensk. Meddel. Dansk Naturhist. Foren. Kjobenhavn 1852(5-7): 79. 1853.

Material seen — [2000-2299, 2300-2699] — *501* (BIGU, MO, TEX, US); *1797* (US); *Standley 65492, 67376, 83306, 85956* (F).

Abundant annual herbs to 1 m with white corollas.

Distribution — Chimaltenango, Guatemala, Quetzaltenango, Santa Rosa, Suchitepéquez. El Salvador, Honduras, Nicaragua, Costa Rica.

Type — San Marcos. Ravines in mixed forest on slopes of Cerro Tunbador, Sierra Madre Mountains, about 15 km W of San Marcos, *Williams, Molina & Williams 23101* (US).

Ageratina mairetiana (DC.) King & H. Rob. Phytologia 19(4): 224. 1970. Synonym: *Eupatorium mairetianum* DC. Prodr. 5: 167. 1836.

Material seen — [2300-2699, 2700-2999] — *1832, 2641* (BIGU, US); *1991* (BIGU, TEX, US).

Shrubs to 4 m with pink corollas.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Guatemala, Huehuetenango, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Totonicapán. Central and southern Mexico, El Salvador.

Ageratina pazcuarensis (Kunth) King & H. Rob. Phytologia 19(4): 215. 1970. Synonym: *Eupatorium pazcuarense* Kunth Nov. Gen. Sp. (folio ed.) 4: 96. 1820.

Material seen — [2300-2699, 2700-2999] — *502,* (BIGU, MO, TEX, US); *1826* (BIGU, MO, US); *Standley 67398, 84808, 85739* (F). Pico Santo Tomas, *Steyermark 34803* (F).

Abundant shrubs to 2.5 m with pink corollas.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Huehuetenango, Jalapa, Quetzaltenango, San Marcos, Sololá, Totonicapán. Central and southern Mexico, Honduras.

Ageratina pichinchensis (Kunth) King & H. Rob. Phytologia 19(4): 215. 1970. Synonyms: *Eupatorium pichinchense* Kunth. Nov. Gen. Sp. (folio ed.) 4: 95-96. 1820. *Ageratina aschenborniana* (Schauer.) H. Rob. Phytologia 19: 212. 1970. *Eupatorium aschenbornianum* Schauer. Linnaea 19: 720. 1847

Material seen — [3000-3399] — *2601* (BIGU, TEX, US).

Perennial herbs to 1.5 m with white corollas common in the Guatemalan mountains.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Guatemala, Huehuetenango, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Santa Rosa, Suchitepéquez, Totonicapán. Central and southern Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, Peru.

Ageratina prunellaefolia (Kunth) King & H. Rob. Phtyologia 19(1): 215-216. 1970. Synonym: *Eupatorium prunellaefolium* Kunth Nov. Gen. Sp. (folio ed.) 4: 96-97. 1820.

Material seen — [2300-2699] —*1706* (BIGU, TEX, US); *1701* (BIGU, US).

Perennial herbs to 1 m with white corollas.

Distribution —Huehuetenango, Jutiapa, Quetzaltenango, Sacatepéquez. Central and southern Mexico, Ecuador. New record for Quetzaltenango.

Ageratina rivalis (Greenm.) King & H. Rob. Phytologia 19(4): 216. 1970. Synonym: *Eupatorium rivale* Greenm. Zoe 5: 186. 1904.

Material seen — [3,4,5] — *724*, *1724*, (BIGU, US); *2618* (BIGU, TEX, US).

Suffrutescent herbs to 1 m with white corollas.

Distribution — Quetzaltenango (Pico Zunil). Central and southern Mexico. New record for Guatemala.

Ageratina saxorum (Standl. & Steyerm.) King & H. Rob. Phytologia 71(3): 171. 1991. Synonym: *Eupatorium saxorum* Standl. & Steyerm. Publ. Field. Mus. Nat. Hist., Bot. Ser. 23(4): 189-190. 1944.

Material seen — [2300-2699] — *1716* (BIGU, US).

Perennial herbs to 20 cm with white corollas.

Distribution — Endemic to the highlands of Huehuetenango, Quetzaltenango, San Marcos. Southern Chiapas, Mexico. New record for Quetzaltenango.

Type — Between Sibinal and summit of Volcán Tacaná, San Marcos, *Steyermark 36075* (F).

Ageratina subinclusa (Klatt) King & H. Rob. Phytologia 38(4): 339. 1978. Synonyms: *Eupatorium subinclusum* Klatt Lepoldiana 20: 75. 1884. *Eupatorium monticola* L. O. Williams Fieldiana, Bot. 36(10): 91. 1975.

Material seen — [2300-2699, 3000-3399] — *737* (BIGU, MO, US); *2515* (BIGU, TEX, US); *533, 1845* (BIGU, US).

Common and attractive shrubs to 5 m with pink corollas on the highest mountains of the western highlands.

Distribution — Chimaltenango, Huehuetenango, Quetzaltenango, Totonicapán. Central and southern Mexico. New record for Quetzaltenango.

Type — From Totonicapán, *Williams, Molina, and Williams 41503* (F).

Ageratina zuniliana (Standl. & Steyerm.) King and H. Rob. Phytologia 19(4): 218. 1970. Synonym: *Eupatorium zunilianum* Standl. & Steyerm. Publ. Field Mus. Nat. Hist., Bot. Ser. 23: 191. 1944.

Material seen — [3000-3399] — *560* (BIGU, TEX, US); *2514A, 2637* (BIGU, US); *Steyermark 34744, 34905* (F).

Perennial herbs to 1.5 m with white corollas.

Distribution — Endemic to Pico Zunil and Pico Santo Tomas, Quetzaltenango.

Type — Pico Zunil, *Steyermark 34744* (F).

Ageratum corymbosum Zuccagni *ex* Pers. Cent. Observ. Bot. 1: [40], sp. no. 85. 1806.

Material seen — [2000-2299, 2300-2699] — *542, 1702* (BIGU, CAS, NY, OMA, US); *1702* (BIGU, TEX, US); *1775* (BIGU, US); *Williams, Molino, and Williams 23011* (F).

Perennial herb to 1 m with purple corollas.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Chiquimula, Escuintla, Guatemala, Huehuetenango, Izabal, Jalapa, Jutiapa, Petén, Quetzaltenango,

Quiché, Sacatepéquez, San Marcos, Santa Rosa, Suchitepéquez, Zacapa. Mexico, El Salvador, Honduras, Nicaragua, Costa Rica.

Bartlettina luxii (B. L. Rob.) King & H. Rob. Phytologia 22: 161. 1971.

Synonym: *Eupatorium luxii* B. L. Rob. Proc. Amer. Acad. Arts 36: 480. 1901.

Material seen — *Standley 67454* (F).

Shrubs or small trees to 6 m with pink or lilac corollas.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Jalapa, Progreso, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá. Southern Mexico, El Salvador.

Type — From Quiché, *Heyde & Lux 3387.*

Bartlettina ornata King & H. Rob. Phytologia 71(3): 172. 1991.

Material seen — [2300-2699] — *519* (BIGU, TEX, US); *2533* (BIGU, US).

Trailing shrubs to 2 m with pink corollas.

Distribution — Endemic. Chimaltenango, Quetzaltenango. Honduras. New record for Quetzaltenango.

Type — Chimaltenango, *Skutch 304* (US).

Bartlettina pinabetensis (B. L. Rob.) King & H. Rob. Phytologia 22: 161. 1971.

Synonym: *Eupatorium pinabetense* B. L. Rob. Proc. Amer. Acad. Arts 36: 482. 1901.

Material seen — *Standley 67391*, *85869* (F).

Shrubs or small trees to 6 m with purplish corollas.

Distribution — Endemic. Quetzaltenango, San Marcos. Chiapas, Mexico.

Critoniadelphus nubigenus (Benth.) King & H. Rob. Phytologia 22: 53. 1971.

Synonym: *Eupatorium nubigenum* Benth. Pl. Hartw. 85. 1841.

Material seen — *Steyermark 34690* (F).

Shrubs or small trees to 9 m with white corollas.

Distribution — Alta Verapaz, Chimaltenango, Chiquimula, Guatemala, Jalapa, Quetzaltenango, Quiché, San Marcos, Suchitepéquez, Zacapa. Southern Mexico, El Salvador, Honduras.

Type — From Las Nubes, Suchitepéquez, *Hartweg 587* (B).

Fleischmannia pycnocephaloides (B. L. Rob.) King & H. Rob. Phytologia 19(4): 205. 1970. Synonym: *Eupatorium pycnocephaloides* B. L. Rob. Proc. Amer. Acad. Arts 51: 534-535. 1916.

Material seen — [1,2,3,4] — *1829* (BIGU, CAS, US); *520, 1816, 2602* (BIGU, MO, US); *2551* (BIGU, NY, TEX, US); *1766, 1854, 1990, 2630* (BIGU, US); *Standley 67384, 83948* (F). Pico Santo Tomas, *Steyermark 34704* (F).

Perennial herbs to 1.5 m with white corollas.

Distribution — Chimaltenango, Guatemala, Huehuetenango, Sacatepéquez, Sololá, Totonicapán. Chiapas, Mexico, Honduras.

Type — From Sololá, *Holway 144.*

Koanophyllon coulteri (B. L. Rob.) King & H. Rob. Phytologia 22: 149. 1971. Synonym: *Eupatorium coulteri* B. L. Rob. Proc. Amer. Acad. Arts 36: 477. 1901.

Material seen — [2000-2299] — *1875* (BIGU, US).

Scandent shrubs to 3 m with greenish yellow corollas.

Distribution — Alta Verapaz, Baja Verapaz, Guatemala, Izabal, Progreso, Quetzaltenango, Sololá, Suchitepéquez, Zacapa. Chiapas, Mexico, El Salvador, Honduras. New record for Quetzaltenango.

Type — From Cobán, *Tuerckheim 52.*

Neomirandea araliifolia (Less.) King & H. Rob. Phytologia 19: 307. 1970. Synonym: *Eupatorium araliifolium* Less. Linnaea 6: 403-404. 1831.

Material seen — *Standley 85972* (F).

Shrubs or small trees to 10 m most common below 2000 m, frequently an epiphytic shrub.

Distribution — Alta Verapaz, Chimaltenango, Izabal, Petén, Progreso, Quetzaltenango, San Marcos, Suchitepéquez. Southern Mexico, Belize, Honduras, Nicaragua, Costa Rica, Panama.

Oxylobus glanduliferus (Sch. Bip.) Gray Proc. Amer. Acad. Arts 15: 26. 1879.

Material seen — [3000-3399, 3400-3542] — *588* (BIGU, F); *2607* (BIGU, OMA); *716* (BIGU, TEX).

Shrubs or suffrutescent herbs to 1 m with white corollas, commonly collected on the upper slopes of the volcanoes of Guatemala.

Distribution — Huehuetenango, Quetzaltenango, San Marcos, Totonicapán. High mountains of southern Mexico, Venezuela.

Peteravenia phoenicolepis (B. L. Rob.) King & H. Rob. Phytologia 21(6): 395. 1971. Synonym: *Eupatorium phoenicolepis* B. L. Rob. Proc. Amer. Acad. Arts 35(16): 338. 1900.

Material seen — [2000-2299] — *1778* (BIGU, US); *Standley 65410, 85872* (F); *Williams, Molina, and Williams 23012* (F).

Attractive shrubs to 3 m with pink corollas.

Distribution — Chimaltenango, Huehuetenango, Progreso, Quetzaltenango, Quiché, Sacatepéquez, Sololá, Zacapa. Southern Mexico, Honduras.

Type — Volcán de Atitlán, Sololá, *W. A. Kellerman 5199* (F).

Peteravenia schultzii (Schnittsp.) King & H. Rob. Phytologia 21(6): 395. 1971. Synonym: *Eupatorium schultzii* Schnittsp. Z. Gartenbau-Vereins Darmstadt 6(1): 6. 1857.

Material seen — [2000-2299] — *2592* (BIGU, US); *Standley 65385, 83325* (F).

Arching suffrutescent shrubs with pink corollas to 3 m.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Escuintla, Guatemala, Huehuetenango, Retalhuleu, Sacatepéquez, Sololá. Central and southern Mexico, El Salvador, Honduras, Costa Rica.

Piptothrix areolaris (DC.) King & H. Rob. Phytologia 19: 426. 1970. Synonyms: *Eupatorium areolare* DC. Prodr. 5: 169. 1836. *Ageratina areolaris* (DC.) Gage *ex* B.L. Turner Phytologia Mem. 2: 19. 1997.

Material seen — [2000-2299, 2300-2699] — *1684* (BIGU, TEX, US); *548, 1765* (BIGU, US).

Shrubs to 5 m with arching branches.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Sacatepéquez, Sololá, Zacapa. Southern Mexico.

Stevia incognita Grashoff Brittonia 26: 357. 1974.

Material seen — [2700-2999] — *1722* (BIGU, US).

Perennial herbs to 1 m.

Distribution — Chimaltenango, Guatemala, Huehuetenango, Jalapa, Progreso, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Totonicapán. Mexico, Honduras, Colombia, Venezuela.

Stevia jorullensis Kunth Nov. Gen. Sp. (folio ed.) 4: 112-113. 1820.

Material seen — [2700-2999] — *536* (BIGU, US). Pico Santo Tomas, *Steyermark 34897* (F).

Perennial herbs to 1 m with pink or purple corollas. This species is extremely variable.

Distribution — Guatemala, Huehuetenango, Quetzaltenango, Sololá, Totonicapán. Mexico.

Stevia lucida var. ***oaxacana*** (DC.) Grashoff Brittonia 26: 365. 1974.

Material seen — [2000-2299, 2300-2699] — *1750* (BIGU, US); *Standley 85780* (F)

Shrubs to 2 m with pink corollas, and it hybridizes with *Stevia polycephala.*

Distribution — Chimaltenango, Huehuetenango, Quetzaltenango, Quiché. Southern Mexico, Costa Rica, Panama, Colombia, Venezuela.

Stevia microchaeta Sch. Bip. Linnaea 25(3): 291. 1852.

Material seen — [3000-3399] — *2603, 2608* (BIGU, US); *2641* (US).

Shrubs to over 4 m with pink and white corollas flowers. This is the largest species in the genus and hybridizes with *Stevia polycephala.*

Distribution — Quetzaltenango, San Marcos. Southern Mexico.

Stevia ovata var. ***ovata*** Willd. Enum. Pl. 855. 1809.

Material seen — [2000-2299] — *Standley 83882* (F). Pico Santo Tomas, *Steyermark 34891* (F).

Perennial herbs to 2 m with white corollas. This species is common in rocky areas and is one of the most variable in the genus.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Guatemala, Huehuetenango, Jutiapa, Quetzaltenango, Sacatepéquez, San Marcos, Sololá, Zacapa. Central and southern Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Ecuador, Peru.

Stevia polycephala var. ***polycephala*** Bertol. Novi Comment. Acad. Sci. Inst. Bononiensis 4: 432. 1840.

Material seen — [2300-2699, 3000-3399, 3400-3542] — *651* (BIGU, MO, US); *551* (BIGU, TEX, US); *1730*, *1844*, *2508*, *2581*, *2613* (BIGU, US); *Standley 67324*, *67388* (F).

Common and abundant shrubs to 2 m with white or pink corollas. *Stevia polycephala* is the most abundant shrub in the genus in Guatemala, and it hybridizes with *S. lucida* var. *oaxacana* and *S. microchaeta,* further adding to the taxonomic confusion.

Distribution — Chimaltenango, Guatemala, Huehuetenango, Quetzaltenango, Sacatepéquez, San Marcos, Sololá, Suchitepéquez, Totonicapán. Southern Mexico.

Type — Volcán de Agua, Sacatepéquez, *Donnell-Smith 2337.*

Stevia triflora DC. Prodr. 5: 115. 1836.

Material seen — [2,3,5] — *537* (BIGU, TEX, US); *1811, 1851, 2572* (BIGU, US).

Perennial herbs to 1.5 m with pink corollas.

Distribution — Alta Verapaz, Chimaltenango, Chiquimula, Guatemala, Quetzaltenango, Huehuetenango. Central and southern Mexico, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, Peru. New record for Quetzaltenango.

Tribe: Gnaphalieae

The Gnaphalieae, formerly placed within the Inuleae, is a diverse tribe with over 180 genera and 2000 species. This tribe has a worldwide distribution but is most diverse in South America and Australia (Bremer, 1994). Most of the members of this tribe are herbs found in montane regions. *Gnaphalium* is the largest and most widespread genus in Guatemala.

Gamochaeta americana (Mill.) Wedd. Chlor. Andina 1: 151. 1856. Synonym: *Gnaphalium americanum* Mill. Gard. Dict. (ed. 8), no. 17. 1768.

Material seen — [2300-2699] — *504* (BIGU, F, NY); *2520* (BIGU, OMA); *2573* (BIGU, TEX).

Biennial herbs to 20 cm, commonly found growing among rocky outcrops.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Chiquimula, Guatemala, Huehuetenango, Jalapa, Progreso, Quetzaltenango, Quiché, Retalhuleu, Sacatepéquez, San Marcos, Sololá, Totonicapán. British Columbia, Southeastern United States, Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama. South America.

Gamochaeta pensylvanica (Willd.) Cabrera Bol. Soc. Arg. Bot. 9: 375. 1961. Synonym: *Gnaphalium pensylvanicum* Willd. Enum. Pl. Hort. Berol.: 867. 1809.

Material seen — [2000-2299, 2300-2699] — *Standley 67322, 83241* (F).

Annual herbs to 30 cm.

Distribution — Guatemala, Jalapa, Quetzaltenango. Southern United States, El Salvador, Honduras, Costa Rica, Panama. Argentina, Bolivia, Ecuador, Paraguay. Caribbean.

Gamochaeta purpurea (L.) Cabrera Bol. Soc. Argent. Bot. 9: 377. 1961. Synonym: *Gnaphalium purpureum* L. Sp. Pl. 2: 854-855. 1753.

Material seen — [1,2,5] — *Standley 67314, 85788* (F); *Steyermark 34849* (F).

Annual herbs.

Distribution — Quetzaltenango. Southeastern United States. South America.

Gnaphalium brachyphyllum Greenm. Field Mus. Bot. 2: 267. 1907.

Material seen — [1,2,5] — *622* (BIGU, F, MO); *1769* (BIGU, OMA); *1689, 2579* (BIGU, TEX); *Standley 84809* (F).

Suffrutescent herbs common in rocky outcrops to 35 cm.

Distribution — Chimaltenango, Quetzaltenango, Quiché, San Marcos, Sololá, Totonicapán. Endemic to the highlands of western Guatemala.

Type — From Cerro Quemado, Quetzaltenango, *Kellerman 5301* (OS).

Gnaphalium brachypterum DC. Prodr. 6: 226. 1837.

Material seen — [2000-2299, 2300-2699] — *Standley 67416, 83873* (F).

Erect plants to 1 m.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Totonicapán. Central and southern Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama.

Gnaphalium liebmanii var. ***monticola*** (McVaugh) D. Nash Fieldiana: Bot. 36(9): 74. 1974.

Material seen — [3,4,5] — *2588* (BIGU, CAS, MO, TEX); *2584* (BIGU, F); *1718* (BIGU, OMA); Pico Santo Tomas, *Steyermark 34886* (F).

Stout herbs to 1 m.

Distribution — Chimaltenango, Huehuetenango, Progreso, Quetzaltenango, Sacatepéquez, San Marcos, Sololá, Totonicapán. Mexico, Costa Rica.

Gnaphalium salicifolium (Bertol.) Sch. Bip. Bot. Ziet. 3: 172. 1845.

Material seen — [2300-2699, 3000-3399] — *561* (BIGU, F, MO); *2509* (BIGU, TEX); Pico Santo Tomas, *Steyermark 34785* (F).

Erect suffrutescent perennials to 40 cm.

Distribution — Chimaltenango, Guatemala, Huehuetenango, Progreso, Quetzaltenango, Quiché, Retalhuleu, Sacatepéquez, San Marcos, Sololá, Totonicapán. Southern Mexico, Costa Rica.

Type — From Volcán de Agua, Sacatepéquez. *Velásquez.*

Gnaphalium semiaplexicaule DC. Prodr. 6: 228. 1837.

Material seen — [2300-2699, 2700-2999, 3000-3399] — *1709* (BIGU, F); *503* (BIGU, MO, NY, OMA); *1821* (BIGU, TEX); *Standley 83273* (F).

Erect perennials to 75 cm.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Chiquimula, Escuintla, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Totonicapán, Zacapa. Mexico, Belize, El Salvador, Nicaragua.

Gnaphalium viscosum Kunth Nov. Gen. & Sp. 4: 82. 1820.

Material seen — [2300-2699] — *1857* (BIGU, F).

Erect annuals to 1 m.

Distribution — Chimaltenango, Chiquimula, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Totonicapán, Zacapa. Texas, Mexico, Honduras.

Tribe: Helenieae

This tribe is found primarily at lower and middle elevations in Guatemala. Presently, the genus *Tagetes* is proposed to be placed in the tribe Tageteae (Panero and Funk, 2002).

Tagetes foetidissima DC. Prodr. 5: 645. 1836.

Material seen — [2300-2699, 2700-2999] — *538* (BIGU, F, MO); *1700* (BIGU, OMA); *1726* (BIGU, TEX).

Erect or spreading annuals to 1 m common in disturbed sites.

Distribution — Chimaltenango, Guatemala, Jalapa, Quetzaltenango, Quiché, San Marcos, Sololá. Central and southern Mexico, El Salvador, Costa Rica.

Tagetes sororia Standl. & Steyerm. Publ. Field Mus. Nat. Hist., Bot. Ser. 23(3): 146. 1944. Synonym: *Tagetes nelsonii* Greenm. Proc. Amer. Acad. Arts 39(5): 117. 1903.

Material seen — [2000-2299, 2300-2699] — *1749* (BIGU, F); *1705* (BIGU, OMA); *1850* (BIGU; TEX); *Standley 83319, 83240* (F).

Perennial and sometimes suffrutescent herbs to 1 m. This is one of the more attractive species of Helenieae found in Guatemala.

Distribution — Totonicapán, Huehuetenango, Quetzaltenango, San Marcos. Chiapas, Mexico.

Type — From mountains north of Olintepeque, Quetzaltenango, *Standley 85228* (F).

Tagetes tenuifolia Cav. Icon. 2: 54, t. 169. 1793.

Material seen — [2000-2299] — *Standley 83207* (F).

Erect annuals to 75 cm.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Escuintla, Guatemala, Huehuetenango, Jalapa, Jutiapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Suchitepéquez, Totonicapán. Mexico, El Salvador, Honduras, Nicaragua, Costa Rica.

Tribe: Heliantheae

Worldwide, the Heliantheae comprises 189 genera and approximately 2500 species making it the third largest tribe with respect to species diversity (Bremer, 1994). This tribe includes the typical sunflowers with radiate heads. Most genera and species are found in North and South America, particularly in Mexico (Bremer, 1994). In Guatemala, the Heliantheae is the largest tribe represented by 67 genera, most of which occur in the highlands. In the recent past, this tribe has been split into several other tribes (Panero and Funk, 2002).

The Heliantheae includes many of the larger trees and shrubs that are common in the montane regions of Guatemala. In December and January, the genera *Bidens, Montanoa, Podachaenium,* and *Verbesina* paint the mountainsides white and yellow.

Acmella filipes var. ***parvifolia*** (Benth.) R. K. Jansen Syst. Bot. Monogr. 8: 59. 1985. Synonym: *Spilanthes parvifolia* Benth. Vidensk. Meddel. Dansk Naturist. Foren. Kjobenhavn 1852(5-7): 100. 1853.

Material seen — [2300-2699] — Standley 85789 (F).

Stoloniferous perennials.

Distribution — Quetzaltenango. Honduras, Nicaragua.

Acmella repens var. ***beccabunga*** (DC.) R. K. Jansen ined. Synonym: *Spilanthes americana* Hieron. Bot. Jahrb. Syst. 29: 42. 1900.

Material seen — [2000-2299, 2300-2699] — *508* (BIGU, F, MO); *1680* (BIGU, TEX); *Standley 65290, 67331, 83218, 83268* (F).

Prostrate perennials to 20 cm common in wet places.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Guatemala, Huehuetenango, Jalapa, Jutiapa, Petén, Progreso, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Santa Rosa, Zacapa. Southeastern United States, Mexico, El Salvador, Costa Rica, Panama. Northwestern South America.

Alepidocline annua Blake J. Wash. Acad. Sci. 24: 441, f. 2. 1934. Synonym: *Sabazia annua* (Blake) Turner Wrightia 5(8): 304. 1976.

Material seen — [2000-2299, 2300-2699] — *1786* (BIGU, F); *2565* (BIGU, TEX); *Standley 83877* (F); *Steyermark 34692* (F).

Distribution — Chimaltenango, Huehuetenango, Quetzaltenango, Sacatepéquez, San Marcos, Sololá, Totonicapán. Chiapas, Mexico.

Type — From Chichavac, Chimaltenango, *Skutch 722* (US).

Alloispermum integrifolium (DC.) H. Rob. Phytologia 38(5): 411-412. 1978. Synonym: *Calea integrifolia* (DC.) Hemsl. Biol. Cent.-Amer., Bot. 2(9): 205. 1881.

Material seen — [2000-2299, 2300-2699] — *547* (BIGU, F, MO); *1880* (BIGU, OMA); *672, 678, 1686, 1760* (BIGU, TEX); *Standley 83952* (F); *L. Williams, A. Molina R., T. Williams 23035* (F).

Distribution — Alta Verapaz, Chimaltenango, Guatemala, Huehuetenango, Jalapa, Petén, Progreso, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Suchitepéquez. Central and Southern Mexico, El Salvador, Honduras, Nicaragua.

Bidens bicolor Greenm. Proc. Amer. Acad. Arts 39(5): 114. 1903

Material seen — [2300-2699, 2700-2999] — *1719* (BIGU, F, OMA); *1849* (BIGU, TEX).

Erect perennials to 1 m.

Distribution — Baja Verapaz, Chimaltenango, Guatemala, Jalapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá, Totonicapán. Chiapas and Oaxaca, Mexico.

Bidens chrysanthemifolia (Kunth) Sherff Bot. Gaz. 61(6): 501. 1916.

Material seen — [1,2,3,4] — *2517* (BIGU, F); *544* (BIGU, NY); *765, 1711* (BIGU, TEX); *Standley 83220, 85784* (F); *Steyermark 34474* (F). Pico Santo Tomas, *Steyermark 34945* (F).

Sprawling perennial herbs to 1 m.

Distribution — Baja Verapaz, Chimaltenango, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá. Central and Southern Mexico, El Salvador, Nicaragua.

Bidens holwayi Sherff & Blake Bot. Gaz. 64: 39. 1917.

Material seen — [2300-2699, 2700-2999, 3000-3399] —*511* (BIGU, CAS, F, NY); *2517* (F); *1733* (BIGU, OMA); *1713, 1823* (BIGU, TEX); *Steyermark 34954* (F).

Scandent shrub common is open areas.

Distribution —Guatemala, Huehuetenango, Quetzaltenango, San Marcos, Sololá. Endemic.

Type — From Quetzaltenango, *Holwayi 816* (GH).

Bidens odorata Cav. Icon. 1(1): 9, pl. 13. 1791.

Material seen — [2000-2299] — *Standley 83260* (F); *Steyermark 34455* (F).

Erect, branched annuals to 1.5 m common along roadsides.

Distribution — Chimaltenango, Guatemala, Huehuetenango, Quetzaltenango, Sacatepéquez, Santa Rosa, Sololá, Totonicapán. Southeastern United States, Mexico. Colombia, Bolivia, Ecuador, Peru.

Bidens ostruthioides (DC.) Sch. Bip. Bot. Voy. Her. 308. 1856.

Material seen — *Steyermark 34743* (F). Pico Santo Tomas, *Steyermark 34707* (F).

Sprawling suffrutescent herbs to 2 m common in moist habitats.

Distribution — Chimaltenango, Huehuetenango, Jalapa, Quetzaltenango, Quiché, San Marcos, Sololá, Totonicapán. Central and Southern Mexico, Costa Rica, Panama.

Bidens squarrosa Kunth Nov. Gen. Sp. (folio ed.) 4: 187. 1820.

Material seen — [2000-2299, 2300-2699] — *1770* (BIGU, F); *1879B* (BIGU, MO); *668* (BIGU, TEX).

Scrambling perennial vines.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Chiquimula, Escuintla, Guatemala, Huehuetenango, Izabal, Jalapa, Jutiapa, Petén, Quetzaltenango, Quiché, Retalhuleu, Sacatepéquez, Santa Rosa, Sololá, Suchitepéquez. Mexico, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, Panama. South America.

Bidens triplinervia Kunth Nov. Gen. Sp. (folio ed.) 4: 182. 1820.

Material seen — [3400-3542] — *714* (BIGU, CAS, F, NY); 2574 (BIGU, MO, OMA, TEX); *Steyermark 34678, 34838* (F).

Perennials with woody rootstocks to 50 cm common on volcano peaks and above timberline.

Distribution — Chimaltenango, Guatemala, Huehuetenango, Quetzaltenango, Sacatepéquez, Totonicapán. Mexico, Costa Rica, Panama. Bolivia, Ecuador, Peru.

Clibadium arboreum Donn. Sm. Bot. Gaz. 14(2): 26. 1889. Synonym: *Clibadium surinamense* L. Mant. Pl. 2: 294. 1771.

Material seen — [2300-2699] — *513* (BIGU, F, TEX); *1703* (BIGU, OMA).

Shrubs and trees to 8 m.

Distribution — Alta Verapaz, Chimaltenango, Escuintla, Guatemala, Izabal, Petén, Retalhuleu, Quetzaltenango, San Marcos, Santa Rosa, Sololá, Suchitepéquez. Southern Mexico, Belize, Honduras, Nicaragua.

Type — From Pansamalá, Alta Verapaz, *H. von Tuerckheim 929.*

Coreopsis mutica DC. var. ***microcephala*** Crawford Brittonia 22: 109. 1970.

Material seen — [2000-2299] — *1774* (BIGU, F); *Standley 83226* (F); L. *Williams, A. Molina R. 14297* (F).

Arching shrubs to 3 m.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Chiquimula, Escuintla, Guatemala, Huehuetenango, Jalapa, Progreso, Quetzaltenango, Quiché, Sacatepéquez, Sololá, Zacapa. Chiapas, Mexico, El Salvador, Honduras.

Cosmos caudatus Kunth Nov. Gen. Sp. (folio ed.) 4: 240. 1820.

Material seen — [3000-3399] — *2626* (BIGU, F, TEX).

Distribution — Chiquimula, Escuintla, Guatemala, Jutiapa, Izabal, Petén, Quetzaltenango, Retalhuleu, Santa Rosa. Mexico, Belize, Honduras, Nicaragua, Costa Rica, Panama. Colombia, Bolivia, Ecuador, Peru. Caribbean. New record for Quetzaltenango.

Dahlia australis (Sherff) Sorenson Rhodora 71: 378. 1969.

Material seen — [3000-3399] — *2511* (BIGU, F).

Perennial herbs to 1 m.

Distribution — Huehuetenango, Quetzaltenango, Quiché, Sololá, Totonicapán. Central and Southern Mexico. New record for Quetzaltenango.

Dahlia imperialis Roezl *ex* Ortgies Gartenflora 12: 243. 1863.

Material seen — [1,2,3,4] — *766, 1752* (BIGU, F); *1996* (BIGU, TEX); *Standley 67468* (F); *Steyermark 34676* (F).

Suffrutescent perennials to 6 m.

Distribution — Alta Verapaz, Chimaltenango, Chiquimula, Guatemala, Huehuetenango, Jalapa, Jutiapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Totonicapán. Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama. Colombia, Bolivia.

Galinsoga ciliata (Raf.) Blake Rhodora 24(278): 35. 1922. Synonyms: *Galinsoga urticifolia* (Kunth) Benth. Bot. Voy. Sulphur 119. 1844. *Galinsoga quadriradiata* Ruiz & Pav. Syst. Veg. Fl. Peruv. Chil. 1: 198. 1798.

Material seen — [2000-2299, 2300-2699] — *1762* (BIGU, F); *2521* (BIGU, TEX).

Erect annual herbs to 50 cm.

Distribution — Alta Verapaz, Chimaltenango, Chiquimula, Escuintla, Guatemala, Huehuetenango, Jalapa, Jutiapa, Progreso, Quetzaltenango, Quiché, Retalhuleu, Sacatepéquez, Santa Rosa, Sololá, Suchitepéquez, Totonicapán, Zacapa. Naturalized in the United States, Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama. Argentina. Caribbean Islands.

Hymenostephium cordatum (Hook. & Arn.) Blake J. Bot. 53: 268. 1915. Synonym: *Viguiera cordata* (Hook. & Arn.) D'Arcy Phytologia 30(1): 6. 1975.

Material seen — [2000-2299, 2300-2699] — *571* (BIGU, F, MO); *2593* (BIGU, NY, OMA); *1776* (BIGU, TEX); *Standley 65350, 65400* (F).

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Chiquimula, Escuintla, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Retalhuleu, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Suchitepéquez. Chiapas, Mexico, El Salvador, Honduras, Costa Rica, Panama. South America.

Jaegeria hirta (Lag.) Less. Syn. Gen. Compos. 223. 1832.

Material seen — [2000-2299, 2300-2699] — *505* (BIGU, F, MO, NY); *1710* (BIGU, MO, TEX); *1791* (BIGU, OMA); *1793* (BIGU, TEX); *Standley 83333* (F).

Annuals to 40 cm.

Distribution — Alta Verapaz., Baja Verapaz, Chimaltenango, Escuintla, Guatemala, Huehuetenango, Izabal, Jalapa, Progreso, Quetzaltenango, Quiché, Retalhuleu, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Suchitepéquez, Totonicapán, Zacapa. Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama. Western South America.

Montanoa guatemalensis B. L. Rob. & Greenm. Proc. Amer. Acad. Arts 34(20): 514. 1899. Synonym: *Montanoa hexagona* B. L. Rob. & Greenm. Proc. Amer. Acad. Arts 34(20): 514. 1899.

Material seen — [2300-2699] — *1782* (BIGU, F).

Shrubs or trees to 15 m.

Distribution — Alta Verapaz, Chimaltenango, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Santa Rosa, Sololá. Mexico, El Salvador, Honduras, Nicaragua, Costa Rica.

Type — From Volcán Jumaytepeque, Santa Rosa, *Heyde & Lux 4216.*

Montanoa pteropoda Blake Proc. Biol. Soc. Wash. 37: 56. 1924.

Material seen — [1,2,3] — *523* (BIGU, F, MO, NY); *1813* (BIGU, OMA); *1745* (BIGU, TEX); *Standley 83232, 84806* (F); *Steyermark 34492, 34608* (F).

Arching shrubs to 4 m.

Distribution — Chimaltenango, Guatemala, Huehuetenango, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Totonicapán. Chiapas, Mexico, El Salvador.

Type — Collected between San Martín and Todos Santos, Huehuetenango, *E. W. Nelson 3616* (US).

Oteiza ruacophila (Donn. Sm.) Fay Phytologia 31: 16. 1975.

Material seen — *Steyermark 34721* (F). Pico Santo Tomas, *Steyermark 34810* (F).

Scrambling shrubs to 5 m.

Distribution — Chimaltenango, Quetzaltenango, Sacatepéquez, San Marcos, Totonicapán. Honduras.

Type — Collected on Volcán Santa Maria, Quetzaltenango, *E. W. Nelson 3727* (US).

Podachaenium eminens (Lag.) Sch. Bip. Flora 44: 557. 1861.

Material seen — [2300-2699] — *666* (BIGU, F, MO, TEX); *Standley 85804* (F); *Steyermark 34584* (F).

Shrubs or trees to 8 m.

Distribution — Alta Verapaz, Chimaltenango, Guatemala, Jalapa, Petén, Progreso, Quetzaltenango, Retalhuleu, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Suchitepéquez, Totonicapán. Mexico, Belize, El Salvador, Honduras, Nicaragua, Costa Rica.

Polymnia maculata var. ***adenotricha*** Blake Contr. Gray. Herb. 52: 34. 1917. Synonym: *Smallanthus maculatus* (Cav.) H. Rob. Phytologia 39: 50. 1978.

Material seen — *769* (BIGU, F).

Erect, perennial herbs to 3 m.

Distribution — [2300-2699] — Guatemala, Jalapa, Quetzaltenango, Santa Rosa, Totonicapán. Southern Mexico, Honduras, Costa Rica.

Type — From Chupadero, Santa Rosa, *Heyde & Lux 3807* (GH).

Polymnia maculata var. ***maculata*** Cav. Icon. 3(1): 14, t. 227. 1794. Synonym: *Smallanthus maculatus* (Cav.) H. Rob. Phytologia 39: 50. 1978.

Material seen — *1746* (BIGU, TEX); *Steyermark 34483* (F).Chiapas, Mexico, Belize, Honduras, Nicaragua, Panama.

Erect, perennial herbs to 3 m.

Distribution — [2300-2699] — Quetzaltenango, Quiché, Retalhuleu. Chiapas, Mexico, Belize, Honduras, Nicaragua, Panama.

Rojasianthe superba Standl. & Steyerm. Publ. Field Mus. Nat. Hist., Bot. Ser. 22(4): 315, f. 1-2. 1940.

Material seen — [1,2,3] — *656* (BIGU, F, TEX); *1874* (BIGU, TEX); *Standley 67400, 85894* (F).

Suffrutescent herbs to 6 m with white ray flowers and blue-grey disc flowers.

Distribution — Huehuetenango, Quetzaltenango, San Marcos. Chiapas, Mexico. Endemic.

Type — Collected between Las Canojas and top of ridge on Volcán Tajumulco, San Marcos, *Steyermark 35835* (F).

Sabazia pinetorum Blake Brittonia 2(4): 347-348. 1937.

Material seen — [2300-2699] — *771* (BIGU, F).

Decumbent perennials to 60 cm.

Distribution — Huehuetenango, Quetzaltenango, Quiché. Chiapas, Mexico. New record for Quetzaltenango. Endemic.

Type — Collected in open pine woods, along trail between Huehuetenango and Soloma, Sierra Cuchumatanes, Huehuetenango, *Skutch 1234* (GH).

Salmea scandens (L.) DC. Cat. Pl. Horti Monsp. 141. 1813.

Material seen — [2000-2299, 2300-2699] — *1714* (BIGU, CAS, OMA); *570* (BIGU, F); *1863* (BIGU, F, MO); *518* (BIGU, MO, NY, TEX); *Standley 65332* (F).

Scandent shrubs with white disc corollas.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Chiquimula, Escuintla, Guatemala, Huehuetenango, Izabal, Petén, Quetzaltenango, Quiché, Retalhuleu, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Suchitepéquez. Mexico, Belize, El Salvador, Honduras, Panama, Bolivia, Ecuador, Peru. Caribbean.

Schistocarpha platyphylla Greenm. Publ. Field Mus., Bot. Ser. 2(6): 274-275. 1907. Synonyms: *Schistocarpha bicolor* Less. Linnaea 6: 409. 1831. *Schistocarpha kellermanii* Rydb. N. Amer. Fl. 34: 306. 1927.

Material seen — [1,2,4] — *727* (BIGU, OMA); *540* (BIGU, OMA, TEX); *772* (BIGU, NY); *2512, 2513, 2519, 2544, 2611, 2622* (BIGU, TEX); *Standley 65369, 83270, 85901* (F); *Steyermark 34622, 35105* (F).

Erect perennial herbs to 2 m.

Distribution — Chimaltenango, Escuintla, Quetzaltenango, Retalhuleu, Sacatepéquez, San Marcos, Suchitepéquez, Totonicapán. Oaxaca and Chiapas, Mexico, El Salvador.

Type — From Volcán Santa Maria, Quetzaltenango, *W. A. Kellerman 5295* (F).

Sigesbeckia jorullensis Kunth Nov. Gen. Sp. (folio ed.) 4: 283. 1820.

Material seen — [2000-2299, 2300-2699] — 1707 (BIGU, F); 506 (BIGU, MO, NY, OMA); 2604 (BIGU, TEX); *Standley 67434, 83369* (F).

Erect annual herbs to 1.5 m with resinous glandular hairs.

Distribution — Chimaltenango, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá, Totonicapán. Central and Southern Mexico, Costa Rica, Panama. Colombia, Bolivia, Ecuador, Peru. Caribbean.

Simsia amplexicaulis (Cav.) Pers. Syn. Pl. 2: 478. 1807.

Material seen — [2000-2299] — *1877B* (BIGU, F, TEX); *Standley 83164, 85789a* (F).

Erect annuals to 1 m.

Distribution — Chimaltenango, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá. Mexico, Honduras.

Squamopappus skutchii (Blake) R. K. Jansen, N. A. Harriman & Urbatsch Syst. Bot. 7(4): 481. 1982. Synonyms: *Podachaenium skutchii* (Blake) H. Rob. Phytologia 38(5): 413-414. 1978. *Calea skutchii* Blake J. Wash. Acad. Sci. 24:438. 1934.

Material seen — [2000-2299, 2300-2699] — *Standley 67387, 67397, 83314* (F).

Shrubs or trees to 8 m.

Distribution — Chimaltenango, Huehuetenango, Quetzaltenango, Quiché, San Marcos, Sololá, Totonicapán. Chiapas, Mexico.

Tithonia longiradiata (Bertol.) Blake Bull. Torrey Bot. Club 53: 217. 1926.

Material seen — [2000-2299] — *Standley 83946, 84811, 85779* (F).

Erect herbs to 4 m.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Huehuetenango, Jalapa, Jutiapa, Petén, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá, Suchitepéquez, Zacapa. Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama.

Tridax procumbens L. Sp. Pl. 2: 900. 1753.

Material seen — [3000-3399] — *2606* (BIGU, F, MO, TEX).

Perennials from woody base to 50 cm.

Distribution — Alta Verapaz, Chimaltenango, Escuintla, Guatemala, Izabal, Jutiapa, Petén, Quetzaltenango, Quiché, Retalhuleu, Sacatepéquez, San Marcos, Santa Rosa, Suchitepéquez, Zacapa. United States (Florida), Mexico, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, Panama. Colombia, Bolivia, Ecuador, Peru, Venezuela, Argentina. Caribbean.

Verbesina apleura Blake Contr. Gray Herb. 52: 53. 1917.

Material seen — [2300-2699, 2700-2999, 3000-3399] — *535* (BIGU, CAS, F); *541* (BIGU, MO, NY); *1721* (BIGU, TEX).

Shrubs or trees to 8 m.

Distribution — Chimaltenango, Guatemala, Progreso, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá, Totonicapán. Chiapas, Mexico, Honduras. Endemic.

Type — From Quetzaltenango, *Holway 739* (GH).

Verbesina holwayi B. L. Rob. Proc. Amer. Acad. Arts 51: 539. 1916.

Material seen — [2300-2699, 2700-2999] — *1827* (BIGU, F); *507* (BIGU, MO, OMA); *2552* (BIGU, TEX).

Herbaceous plants to 3 m.

Distribution — Huehuetenango, Quetzaltenango. Endemic.

Type — From Quetzaltenango, Quetzaltenango, *Holway 96*.

Verbesina hypoglauca Sch. Bip. *ex* Klatt Leopoldiana 23: 144. 1887.

Material seen — [3000-3399, 3400-3542] — *554* (BIGU, CAS, F); *577* (BIGU, MO, TEX); *1997* (BIGU, NY, TEX); *2617* (BIGU, OMA); *644, 718* (BIGU, TEX); *Steyermark 34796* (F).

Distribution — Chimaltenango, Guatemala, Huehuetenango, Quetzaltenango, San Marcos, Sololá, Totonicapán. Central and Southern Mexico.

Verbesina sousae Fay Brittonia 25: 195. 1973.

Material seen — [2700-2999] — *668* (BIGU, F).

Shrubs to 3 m.

Distribution — Quetzaltenango. Chiapas and Oaxaca, Mexico. New record for Guatemala.

Verbesina sublobata Benth. Pl. Hartw. 76. 1841.

Material seen — [2000-2299] — *1741* (BIGU, TEX); *1878B* (BIGU, F, OMA); *Standley 83184, 85773* (F).

Erect herbs and shrubs to 3 m.

Distribution — Alta Verapaz, Chimaltenango, Chiquimula, Guatemala, Huehuetenango, Quetzaltenango, Sacatepéquez, San Marcos, Santa Rosa, Sololá. Chiapas, Mexico, El Salvador, Honduras, Costa Rica, Panama.

Tribe: Lactuceae

Formerly the Cichorieaae, many of the species in this tribe have milky latex. The Lactuceae comprises 98 genera and over 1500 species with a center of distribution in Europe and North America (Bremer, 1994). In Guatemala, many of the species are exotic, naturalized species from the Old World. *Hieracium,* the largest native genus in Guatemala, is abundant in the highlands.

Hieracium guatemalense Standl. & Steyerm. Publ. Field Mus. Nat. Hist., Bot. Ser. 23(2): 101-102. 1944.

Material seen — *Steyermark 34860* (F).

Perennials from woody rootstocks to 25 cm.

Distribution — Huehuetenango, Quetzaltenango, San Marcos, Zacapa. Endemic.

Type — Dry rocky edge of barranco, uppermost ridge to summit of Pico Zunil, Quetzaltenango, *Steyermark 34860* (F).

Hieracium irazuense Benth. Vidensk. Meddel. Dansk Naturhist. Foren. Kjobenhavn 1851: 113. 1853.

Material seen — [2300-2699, 3400-3542] — *620* (BIGU, F); *549* (BIGU, MO, TEX); *2529, 2575* (BIGU, TEX). Pico Santo Tomas, *Steyermark 34815b* (F).

Perennials to 80 cm.

Distribution — Chimaltenango, Guatemala, Huehuetenango, Jalapa, Progreso, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá, Totonicapán. Chiapas, Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama.

Hypochaeris glabra L. Sp. Pl. 2: 811. 1753.

Material seen — [2300-2699, 3400-3542] — *546* (BIGU, F); *705* (BIGU, TEX).

Erect perennials to 50 cm.

Distribution — Guatemala, Quetzaltenango, San Marcos, Sololá, Totonicapán. Naturalized throughout North and South America. Native of Europe and Asia.

Sonchus oleraceus L. Sp. Pl. 2: 794. 1753.

Material seen — [1,2,4] — *545* (BIGU, F); *584* (BIGU, MO, TEX); *1708* (BIGU, OMA); *Standley 67404* (F); *Steyermark 34425, 34680* (F).

Erect annuals to 1 m.

Distribution — Alta Verapaz, Chimaltenango, Escuintla, Guatemala, Huehuetenango, Jalapa, Petén, Quetzaltenango, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Totonicapán, Zacapa. United States, Mexico to Panama. South America. Native to the Old World.

Taraxacum officinale Wigg. Prim. Fl. Holsat. 56. 1780.

Material seen — [2000-2299, 2300-2699] — *763* (BIGU, F); *Standley 83208, 83382, 85795* (F).

Perennials from taproot to 25 cm.

Distribution — Alta Verapaz, Chimaltenango, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Sacatepéquez, San Marcos, Totonicapán. Naturalized throughout North America, Central America, and South America. Native of the Old World.

Tribe: Liabeae

The Liabeae is one of the smallest and taxonomically best known tribes in the Asteraceae (Bremer, 1994). Formerly placed within Vernonieae, members of the Liabeae are mainly Andean in distribution with most of the species occurring in Peru and Ecuador. In Guatemala, the tribe includes perennial herbs, both terrestrial and epiphytic shrubs, and small trees. All are characterized by opposite leaves, distinguishing them from Guatemalan Vernonieae.

Sinclairia discolor Hook. & Arn. Bot. Beechey Voy. 433. 1841. Synonym: *Liabum discolor* (Hook. & Arn.) Benth. & Hook *ex* Hemsl. Biol. Cent.-Amer. Bot. 2(9): 232. 1881.

Material seen — [2000-2299] — *J. R. S. 1800* (F).

Shrubs or small trees to 4 m, rarely epiphytic.

Distribution — Alta Verapaz, Progreso, Guatemala, Quetzaltenango, Sacatepéquez; San Marcos. Southern Mexico, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, Panama.

Tribe: Mutiseae

The Mutiseae is a relatively small tribe with 76 genera and approximately 970 species. It is more common in the New World than elsewhere (Bremer, 1994). Only one species has been reported from Pico Zunil.

Trixis inula Crantz Inst. Rei. Herb. 1: 329. 1766.

Material seen — [2000-2299] — *E. W. Nelson 3696* (F); *Standley 83182, 84821* (F).

Erect, much-branched shrubs to 3 m.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Chiquimula, Escuintla, Guatemala, Huehuetenango, Jutiapa, Petén, Progreso, Quetzaltenango, Quiché, Retalhuleu, Sacatepéquez, Santa Rosa, Sololá, Zacapa. United States (Texas), Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Peru, Venezuela. Jamaica.

Tribe: Senecioneae

In number of species, the Senecioneae is the largest tribe with more than 3000 species in 120 genera that are distributed globally with prominent concentrations in Central and South America, tropical and South Africa, and Central and East Asia (Bremer, 1994). In Latin America, many taxonomic revisions have occurred within the *Senecio sensu lato* group (Barkley, 1985; Barkley et al., 1996).

In Guatemala, *Roldana* is the most diverse genus including mostly shrubs and small trees that are a characteristic component of the highlands. A revision of the species of *Roldana* from Mexico recently was completed (Turner, 2005).

Barkleyanthus salicifolius (Kunth) H. Rob. & Brettell Phytologia 27(6): 407. 1974. Synonyms: *Cinereria salicifolia* Kunth Nov. Gen. Sp. (folio ed.) 4: 148. 1820. *Senecio salignus* DC. Prodr. 6: 430. 1837.

Material seen — [2000-2299] — Standley 83185 (F).

Erect, branched shrubs to 2.5 m.

Distribution — Baja Verapaz, Chimaltenango, Escuintla, Guatemala, Huehuetenango, Jalapa, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Totonicapán. Mexico, El Salvador.

Erechtites valerianifolius (Link *ex* Spreng.) DC. Prodr. 6: 295. 1838.

Material seen — [2000-2299, 2300-2699] — *528* (BIGU, F, MO); *1888* (BIGU, TEX).

Annual herbs to 1 m with purple heads.

Distribution — Alta Verapaz, Chimaltenango, Guatemala, Huehuetenango, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá, Zacapa. Southern Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama. Tropical South America.

Roldana acutangula (Bertol.) H. Rob. & Brettell Phytologia 27(6): 415. 1974. Synonym: *Senecio acutangulus* (Bertol.) Hemsl. Biol. Cent.-Amer., Bot. 2(10): 235. 1881.

Material seen — [2,3,5] — *729, 2554* (BIGU, F); *1817* (BIGU, MO, TEX); *Standley 67334, 67483* (F).

Shrubs or trees to 4 m.

Distribution —Chimaltenango, Huehuetenango, Quetzaltenango, San Marcos, Totonicapán. Chiapas, Mexico. Endemic.

Roldana aschenborniana (Schauer) H. Rob. & Brettell Phytologia 27(6): 415. 1974. Synonyms: *Senecio aschenbornianus* Schauer Linnaea 20(6): 698-699. 1847. *Senecio quezalticus* L. O. Williams Phytologia 31(6): 446. 1975. *Roldana quezaltica* (L. O. Williams) H. Rob. Phytologia 32(4): 331. 1975.

Material seen — [2700-2999, 3000-3399] — *1717* (BIGU, F); *2621* (BIGU, OMA); *2504* (BIGU, TEX);

Shrubs to 4.5 m.

Distribution — Chimaltenango, Jalapa, Quetzaltenango, Sacatepéquez. Mexico.

Type — (*S. quezalticus)* From damp hillside forest in mountains SE of Palestina on old road to San Juan Ostunculco, Quetzaltenango, *Standley 84286* (F).

Roldana barba-johannis (DC.) H. Rob. & Brettell Phytologia 27(6): 415. 1974. Synonym: *Senecio barba-johannis* DC. Prodr. 6: 430. 1838.

Material seen — [3000-3399] — *2609* (BIGU, F); *Steyermark 34889* (F).

Shrubs to 4 m.

Distribution — Chimaltenango, Huehuetenango, Progreso, Sacatepéquez, Sololá. Mexico.

Roldana gilgii (Greenm.) H. Rob. & Brettell Phytologia 27(6): 419. 1974. Synonym: *Senecio gilgii* Greenm. Publ. Field Mus., Bot. Ser. 2(6): 282. 1907.

Material seen — [2300-2699, 2700-2999, 3000-3399] — *525* (BIGU, CAS, OMA); *667* (BIGU, F); *2589* (BIGU, MO, TEX); *1725, 1842, 1847, 2531* (BIGU, TEX); *Standley 67378* (F); *Steyermark 34596* (F).

Common shrubs to 4 m.

Distribution — Chimaltenango, Guatemala, Quetzaltenango, Quiché, San Marcos, Sololá, Suchitepéquez, Totonicapán. Chiapas, Mexico. Endeimc.

Roldana heterogama (Benth.) H. Rob. & Brettell Phytologia 27(6): 420. 1974. Synonym: *Senecio heterogamus* (Benth.) Hemsl. Biol. Cent.-Amer., Bot. 2(10): 242. 1881.

Material seen — [2300-2699, 3000-3399, 3400-3542] — *586, 713* (BIGU, F); *534* (BIGU, MO, OMA); *2624* (BIGU, TEX); *Standley 67453, 85837* (F).

Shrubs to 2.5 m.

Distribution — Chimaltenango, Guatemala, Huehuetenango, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá, Totonicapán. Chiapas, Mexico, Costa Rica, Panama.

Roldana jurgensenii (Hemsl.) H. Rob. & Brettell Phytologia 27(6): 421. 1974. Synonym: *Senecio jurgensenii* Hemsl. Biol. Cent.-Amer., Bot. 2(10): 242. 1881.

Material seen — [2300-2699, 3000-3399] — *2639* (BIGU, F); *526* (BIGU, MO, TEX); *2623* (BIGU, OMA); *1995* (BIGU, TEX); *Standley 67368, 84955a* (F).

Shrubs to 5 m.

Distribution — Chimaltenango, Huehuetenango, Progreso, Quetzaltenango, Quiché, San Marcos, Sololá, Suchitepéquez, Totonicapán. Southern Mexico, El Salvador, Honduras.

Roldana petasitis (Sims) H. Rob. & Brettell Phytologia 27(6): 423. 1974. Synonyms: *Senecio petasitis* (Sims) DC. Prodr. 6: 431. 1838. *Senecio petasioides* Greenm. Bot. Gaz. 37(6): 419-420. 1904. *Roldana petasioides* (Greenm.) H. Rob. Phytologia 32: 331. 1975.

Material seen — [2000-2299, 2300-2699] — *Standley 65377, 83178, 84804, 85734* (F); *Steyermark 34595* (F).

Shrubs to 2 m.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Escuintla, Guatemala, Huehuetenango, Jutiapa, Progreso, Quetzaltenango, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Totonicapán, Zacapa. Chiapas, Mexico, El Salvador, Honduras, Nicaragua.

Type — *(S. petasioides)* From Ceneguilla, Santa Rosa, *Heyde & Lux 4522* (MO).

Senecio callosus Sch. Bip. Flora 28: 498. 1845.

Material seen — [3000-3399, 3400-3542] — *2570* (BIGU, F); *Steyermark 34900* (F).

Erect, perennial herbs to 1 m.

Distribution — Chimaltenango, Huehuetenango, Quetzaltenango, Sacatepéquez, San Marcos, Sololá, Totonicapán. Mexico.

Senecio doratophyllus Benth. Pl. Hartw. 87. 1841. Synonym: *Senecio godmanii* Hemsl. Biol. Cent.-Amer., Bot. 2(10): 240-241. 1881.

Material seen — [2300-2699, 2700-2999] — *1720* (BIGU, F); *1812, 1837* (BIGU, TEX); *Standley 67369, 85692* (F).

Glabrous, perennial herbs to 2 m.

Distribution — Chimaltenango, Huehuetenango, Jalapa, Progreso, Quetzaltenango, Quiché, Sacatepéquez, San Marcos, Sololá, Suchitepéquez, Totonicapán. Chiapas, Mexico, Honduras.

Type — From summit of Volcán Acatenango, Sacatepéquez, *Hartweg 594* (K).

Senecio godmanii Hemsl. Biol. Cent.-Amer., Bot. 2(10): 240-241. 1881.

Material seen — [2700-2999, 3000-3399] — *578, 1723* (BIGU, F); *645* (BIGU, MO, TEX); *2620* (BIGU, TEX).

Perennial herb to 2.5 m.

Distribution — Guatemala, Huehuetenango, Quetzaltenango, Sacatepéquez. Mexico.

Type — From Volcán de Agua, Sacatepéquez, *Salvin & Godman 327* (K).

Senecio rhyacophilus Greenm. Publ. Field Mus., Bot. Ser. 2(6): 280. 1907.

Material seen — [2700-2999, 3000-3399] — *2583* (BIGU, F); *2591* (BIGU, MO, OMA); *2629* (BIGU, TEX).

Perennial herbs to 1 m with purple corollas.

Distribution —Huehuetenango, Quetzaltenango, Quiché, Sacatepéquez. New record for Quetzaltenango. Endemic.

Type — From Volcán de Fuego, Sacatepéquez, *Heyde & Lux 4502* (US).

Senecio vulgaris L. Sp. Pl. 2: 867. 1753.

Material seen — [2300-2699] — *2516* (BIGU, F).

Annual herbs to 20 cm common in greenhouses and in agricultural crop lands.

Distribution — Only reported from Quetzaltenango, but expected in all departments. Naturalized throughout the New World. Native of Europe and Asia.

Senecio warszewiczii Braun & Bouché Index Sem. (Berlin) 13. 1851

Material seen — [2300-2699, 3000-3399, 3400-3542] — *721, 2585* (BIGU, F); *2577* (BIGU, MO, TEX); *720* (BIGU, OMA); *1820, 2600* (BIGU, TEX); *Standley 67405, 85760* (F).

Distribution — Chimaltenango, Guatemala, Huehuetenango, Quetzaltenango, San Marcos, Sololá, Totonicapán. Volcán Tacana, Chiapas, Mexico. Endemic.

Telanthophora cobanensis (Coult.) H. Rob. & Brettell Phytologia 27(6): 423. 1974. Synonym: *Senecio cobanensis* Coult. Bot. Gaz. 16(4): 101. 1891.

Material seen — [2300-2699] — *1784* (BIGU, F).

Shrub or tree to 9 m.

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Huehuetenango, Progreso, Quetzaltenango, San Marcos, Sololá, Suchitepéquez. Chiapas, Mexico, El Salvador, Honduras. New record for Quetzaltenango.

Type — From Cobán, Alta Verapaz, *Tuerckheim 1158.*

Telanthophora grandifolia H. Rob. & Brettell Phytologia 27(6): 427. 1974. Synonyms: *Senecio grandifolius* Less. Linnaea 5: 162. 1830. *Senecio arborescens* Steetz Bot. Voy. Herald 162, t. 31. 1854. *Telanthophora arborescens* (Steetz) H. Rob. & Brettell Phytologia 27(6): 426. 1974.

Material seen — [2300-2699] — *2561* (BIGU, F, TEX).

Shrub or tree to 12 m.

Distribution — Alta Verapaz, Escuintla, Guatemala, Quetzaltenango, Quiché, San Marcos. Chiapas, Mexico, Nicaragua, Costa Rica, Panama.

Tribe: Vernonieae

The Vernonieae is most prevalent from the middle elevations to the lowland regions of Guatemala where it is represented by herbs, shrubs, and small trees characterized by alternate leaves. In Guatemala, the genus *Vernonia* is by far the most diverse with 19 indigenous species.

Vernonia arborescens (L.) Sw. Fl. Ind. Occid. 3: 1320. 1806. Synonyms: *Lepidaploa arborescens* (L.) H. Rob. Proc. Biol. Soc. Wash. 103(2): 481. 1990. *Vernonia canescens* Kunth Nov. Gen. Sp. (folio ed.) 4: 27-28, tab. 317. 1820. *Lepidaploa canescens* (Kunth) H. Rob. Proc. Biol. Soc. Wash. 103(2): 483. 1990.

Material seen — [2000-2299, 2300-2699] — *1759* (BIGU, F); *2540* (BIGU, TEX); *E. W. Nelson 3691* (F); *Steyermark 34965* (F).

Vernonia arborescens plants are attractive suffrutescent herbs with arching branches that reaches 3 m in height. All material collected at anthesis possessed purplish

disc corollas. There is current disagreement regarding the synonymy of *Vernonia arborescens* and *V. canescens.*

Distribution — Chimaltenango, Chiquimula, Guatemala, Quetzaltenango, Sacatepéquez, Santa Rosa. Southern Mexico, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Venezuela, Bolivia, Ecuador, Peru. The Antilles.

Vernonia leiocarpa DC. Prodr. 5: 34. 1836. Synonym: *Critoniopsis leiocarpa* (DC.) H. Rob. Proc. Biol. Soc. Wash. 106(3): 615. 1993.

Shrubs or trees to 10 m with pinkish to lavender corollas.

Material seen — *Standley 83233* (F).

Distribution — Alta Verapaz, Baja Verapaz, Chimaltenango, Chiquimula, Guatemala, Huehuetenango, Jalapa, Jutiapa, Quetzaltenango, Sacatepéquez, San Marcos, Santa Rosa, Sololá, Totonicapán, Zacapa. Chiapas, Mexico, Belize, El Salvador, Honduras, Nicaragua.

Vernonia salvinae Hemsl. Biol. Cent.-Amer., Bot. 2(7): 73-74, t. 41. 1881. Synonym: *Lepidonia salvinae* (Hemsl.) H. Rob & Funk Bot. Jahrb. Syst. 108: 225. 1987.

Material seen — *Skutch 953* (F).

Shrubs or small trees to 6 m with purple corollas.

Distribution —Quetzaltenango, Quiché, San Marcos. Southern Mexico.

Type — From Las Nubes, Pico Zunil, *Salvin s.n* (K).

Discussion

The Asteraceae identified in this study provide both a second data point in time for the flora of Pico Zunil and a more comprehensive baseline against which future comparisons can be made. Of the 126 species of Asteraceae collected from 2003-2005, 53 previously had not been collected whereas 25 other Asteraceae were collected previously but not in the present study. The most likely explanation for the greater number of species collected at Pico Zunil during 2003-2005 was the greater time spent collecting. During my 5 trips to the site, I spent over 50 days in the field compared to an estimated 7 days spent by other investigators during their visits to the site. In addition to time spent collecting, many of the species newly reported were collected in habitat disturbed by anthropogenic land use practices which may not have been as prevalent in the past. The absence of the 25 species from the present study may be a consequence of my sampling protocol which did not focus on epiphytic Asteraceae, such as the genera *Mikania* (Eupatorieae) and *Pentacalia* (Senecioneae), which were present in the area but not included in my collections. Land use changes or changes in climate also may have played a role in the local extirpation of some species of Asteraceae.

Elevational differences in species' presence, included in the present study, could not be compared temporally because past studies did not record sufficiently detailed information about the elevation at which collections were made. Data from the present study, however, will allow for better and more refined comparisons with future studies. For example, the number and distribution of native Asteraceae found in the present study at 2300-2699 m, the elevation at which most human disturbance presently occurs, will

provide an important base against which to infer the impact of such continued anthropogenic activities. On a broader scale, comparisons between the present and future studies may show changes in the elevational distribution of either the number of Asteraceae species present or the occurrence of particular species at particular elevations. Such comparisons could hint at plant responses to widespread changes in global conditions, such as might occur with global warming.

To best incorporate present and future studies for the purpose of assessing temporal changes in Asteraceae, studies must involve ongoing, joint efforts by conservation-focused organizations and federal or local government agencies. Such cooperation will also facilitate development of a more thorough biodiversity inventory of the volcanic belt and associated cloud forest ecosystems, as well as encourage the Guatemalan government to work more closely with conservation groups to protect regions whose native communities are threatened.

References Cited

Almeda, F. 1993. *Stanmarkia,* a new genus of Melastomataceae from the volcanic highlands of western Guatemala and adjacent Mexico. Brittonia 45: 187-203.

Anderson, T. 1908. The volcanoes of Guatemala. The Geographical Journal 31: 473-491.

Barkley, T. M. 1985. Infragenric groups in *Senecio, s.l.,* and *Cacalia, s.l.* (Asteraceae: Senecioneae) in Mexico and Central America. Brittonia 37: 211-218.

Barkley, T. M., B. L. Clark and A. M. Funston. 1996. The segregate genera of *Senecio sensu lato* and *Cacalia sensu lato* (Asteraceae: Senecioneae) in Mexico and Central America, pp. 613-620. *In* D. J. N. Hind and H. J. Beentje (eds.), Compositae: Systematics. Proceedings of the International Compositae Conference, Kew, 1994.

Beard, J. S. 1944. Climax vegetation in tropical America. Ecology 25: 127-158.

Breedlove, D. E. 1981. Introduction to the flora of Chiapas. Flora of Chiapas Part 1: 1-35. California Academy of Sciences, San Francisco.

Bremer, K. 1994. Asteraceae: Cladistics and Classification. Timber Press. Portland, Oregon.

Bruijnzeel, L. A. and E. J. Veneklaas. 1998. Climatic conditions and tropical montane forest productivity: the fog has not lifted yet. Ecology 79: 3-9.

Dillon, M. O., N. A. Harriman, B. L. Turner, S. C. Keeley, D. J. Keil, T. F. Stuessy, S. Sundberg, R. K. Jansen and D. M. Spooner. 2000. Asteraceae, pp. 271-392. *In* W. D. Stevens, C. Ulloa C., A. Pool and O. M. Montiel (eds.), Flora de Nicaragua. Monographs in Systematic Botany 85. Missouri Botanical Garden Press, St. Louis.

Gall, F. 1983. Diccionario Geográfico de Guatemala, De la letra Q a la S. Compilación critica. Tomo III. Instituto Geográfico Nacional, Guatemala, C. A.

Hamilton, L. S., J. O. Juvnik and F. N. Scatena. 1995. Tropical Montane Cloud Forests. Springer-Verlag. New York.

Holmgren, P. K. and W. Keuken. 1974. Index Herbariorum. Part I. The Herbaria of the World. Sixth Ed. Utrecht, The Netherlands.

Howell, S. N. G. and S. Webb. 1995. A Guide to the Birds of Mexico and Northern Central America. Oxford University Press, Oxford.

Kessler, M. 2002. The elevational gradient of Andean plant endemism: varying influences of taxon-specific traits and topography at different taxonomic levels. Journal of Biogeography 29: 1159-1165.

King, R. M. and H. Robinson. 1987. The Genera of the Eupatorieae (Asteraceae). Monographs in Systematic Botany 22. Missouri Botanical Garden Press, St. Louis.

Lawton, R. O., U. S. Nair, R. A. Pielke Sr. and R. M. Welch. 2001. Climatic impact of tropical lowland deforestation on nearby montane cloud forests. Science 294: 584-587.

Leopold, A. S. 1950. Vegetation zones in Mexico. Ecology 31: 507-518.

McCarty, J. P. 2001. Ecological consequences of recent climate change. Conservation Biology 15: 320-331.

Nash, D. L. and L. O. Williams. 1976. Flora of Guatemala: Asteraceae. Fieldiana: Botany. Vol. 24, pt. 12. Field Museum of Natural History, Chicago.

Panero, J. L. and V. A. Funk. 2002. Toward a phylogenetic subfamilial classification for the Compositae (Asteraceae). Proceedings of the Biological Society of Washington 115: 909-922.

Pounds, J. A., M. P. L. Fogden and J. H. Campbell. 1999. Biological response to climate change on a tropical mountain. Nature 398: 611-615.

Pruski, J. F. and G. Sancho. 2004. Asteraceae, pp. 33-39. *In* N. Smith, S. A. Mori, A. Henderson, D. W. Stevenson and S. V. Heald (eds.), Flowering Plants of the Neotropics. Princeton University Press, Princeton.

Raven, P. H. and D. I. Axelrod. 1974. Angiosperm biogeography and past continental movements. Annals of the Missouri Botanical Garden 61: 539-657.

Robinson, H. and R. Brettell. 1975. Studies in the Senecioneae (Asteraceae). Phytologia 27: 402-439.

Solomon, J. 1996. TROPICOS: An example of linked specimen and taxon databases. pp. 1-8. *In*: Workshop on Application of Information Systems on Botanical Inventory. Institute of Botany, Academia Sinica, Taipei.

Skutch, A. F. 1979. The Imperative Call. University Presses of Florida. Gainesville.

Steyermark, J. A. 1950. Flora of Guatemala. Ecology 31: 368-372.

Still, C. J., P. N. Foster and S. H. Schneider. 1999. Simulating the effects of climate change on tropical montane cloud forests. Nature 398: 608-610.

Strother, J. L. 1999. Compositae-Heliantheae S.L. Flora of Chiapas, Part 5. California Academy of Sciences, San Francisco.

Turner, B. L. 2005. A recension of the Mexican species of *Roldana* (Asteraceae: Senecioneae). Phytologia 87: 204-263.

Veblen, T. T. 1977. The urgent need for forest conservation in highland Guatemala. Biological Conservation 9: 141-154.

Veblen, T. T. 1978. Forest preservation in the western highlands of Guatemala. Geographical Review 4: 417-434.

Véliz Pérez, M. E. 2000. La vegetación del volcán de Acatenango, Guatemala. Revista de Ciencia y Tecnología [Universidad de San Carlos de Guatemala] 5: 3-168.

Véliz Pérez, M. E., N. R. G. Pérez, M. G. V. Gil and R. L. Soberanis. 2001. La vegetación montaña de Guatemala. Revista de Ciencia y Tecnología [Universidad de San Carlos de Guatemala] 6: 3-61.

Villaseñor, J. L., G. Ibarra and D. Ocaña. 1998. Strategies for the conservation of Asteraceae in Mexico. Conservation Biology 12: 1066-1075.

Williams, H. 1960. Volcanic history of the Guatemalan highlands. University of California Publications in Geological Sciences. 38: 1-86.

Appendix

Appendix Table 1. Asteraceae collected in the Departments of Sololá and Quetzaltenango at or above 1300 meters that include Pico Zunil. Unless otherwise indicated by a superscript, species on this list were compiled from vouchers examined at the Field Museum of Natural History in Chicago and collected for the Flora of Guatemala (Nash and Williams, 1976).

Anthemideae
Matricaria courrantiana DC.

Astereae
Archibaccharis aequivenia (Blake) D. Nash
Archibaccharis asperifolia (Benth.) Blake
Archibaccharis blakeana Standl. & Steyerm.
Archibaccharis corymbosa (Donn. Sm.) Blake
Archibaccharis flexilis Blake
Archibaccharis hirtella var. *taeniotricha* Blake
Archibaccharis schiedeana (Benth.) J. D. Jackson
Archibaccharis serratifolia (Kunth) Blake
Aster subulatus Michx. = *Symphyotrichum subulatum* (Michx.) Nesom
Aster trilineatus Sch. Bip. *ex* Klatt = *Symphyotrichum trilineatum* (Sch. Bip. *ex* Klatt) Nesom
Baccharis pedunculata (Mill.) Cabrera
Baccharis salicifolius (Ruiz. & Pav.) J. D. Jackson
Baccharis serraefolia DC.
Baccharis trinervis (Lam.) Persoon
Baccharis vaccinioides Kunth
Conyza bonariensis (L.) Cronquist
Conyza canadensis (L.) Cronquist
Conyza coronopifolia Kunth
Conyza filaginoides (DC.) Hieron.
Conyza schiedeana (Less.) Cronquist
Conyza sophiifolia Kunth
Erigeron karvinskianus DC.
Erigeron scaposus DC.
Osbertia stolonifera (DC.) Greene

Carduceae
Cirsium guatemalense Blake[1]
Cirsium mexicanum DC.
Cirsium radians Benth.
Cirsium subcoriaceum (Less.) Sch. Bip.

Eupatorieae
Adenostemma hirtiflorum Benth.
Ageratina bellidifolia (Benth.) King & H. Rob.
Ageratina caeciliae (B. L. Rob.) King & H. Rob.
Ageratina crassiramea (B. L. Rob.) King & H. Rob.
Ageratina helenae King & H. Rob.
Ageratina ligustrina (DC.) King & H. Rob.

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Ageratina mairetiana (A. P. Decandolle) King & H. Rob.
Ageratina pazcuarensis (Kunth) King & H. Rob.
Ageratina pichinchensis (Kunth) King & H. Rob.
Ageratina ovilla (Standl. & Steyerm.) King & H. Rob
Ageratina valeroi King & H. Rob.
Ageratina zunilana (Standl. & Steyerm.) King & H. Rob.
Ageratum conyzoides L.
Ageratum corymbosum Zuccagni *ex* Pers.
Ageratum rugosum J.M. Coult.
Amolinia heydeana (Rob.) King & H. Rob.
Bartlettina luxii (B. L. Rob.) King & H. Rob.
Bartlettina pinabetensis (B. L. Rob.) King & H. Rob.
Bartletitna tuerckheimii (Klatt) King & H. Rob.[1]
Brickellia pacayensis Coult.
Brickellia paniculata (Mill.) H. Rob.
Brickellia scoparia (DC.) Gray
Chromolaena collina (DC.) King & H. Rob.
Critonia morifolia (Mill.) King & H. Rob.
Critonia quadrangularis (DC.) King & H. Rob.
Eupatoriastrum angulifolium (Rob.) King & Rob.
Eupatorium rojasianum Standl. & Steyerm.
Fleischmannia jejuna (Standl. & Steyerm,) King & H. Rob.
Fleischmannia multinervis (Benth.) King & H. Rob.
Fleischmannia pycnocephala (Less.) King & H. Rob.
Fleischmannia pycnocephaloides (B. L. Rob.) King & H. Rob.
Fleischmannia sinclairii (Benth.) King & H. Rob.
Fleischmannia viscidipes (B. L. Rob.) King & H. Rob.
Fleischmanniopsis leucocephala (Benth.) King & Rob.
Fleischmannia microstemon (Cass.) King & H. Rob.
Koanophyllon galeottii (B. L. Rob.) King & H. Rob.
Koanophyllon mimica (Standl. & Steyerm.) King & H. Rob.
Mikania cordifolia (L. f.) Willd.
Mikania houstoniana (L.) B. L. Rob.
Mikania petrina Standl. & Steyerm.
Neomir&ea araliaëfolia (Less.) King & H. Rob.
Oxylobus gl&uliferus (Sch. Bip.) Gray
Peteravenia phoenicolepis (B. L. Rob.) King & H. Rob.
Peteravenia schultzii (Schnittsp.) King & H. Rob.
Piptothrix areolaris (DC.) King & H. Rob.
Piqueria trinervia Cav.
Stevia connata Lag.
Stevia jorullensis Kunth

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Stevia lucida var. *oaxacana* (DC.) Grashoff
Stevia microchaeta Sch. Bip.
Stevia ovata var. *ovata* Willd.
Stevia polycephala var. *polycephala* Bertol.
Stevia suaveolens Lag.[1]
Stevia serrata Cav.

Gnaphalieae
Achyrocline deflexa B. L.Rob. & Greenm.
Achyrocline turneri Nesom
Gamochaeta americana (Mill.) Wedd.
Gamochaeta pensylvanica (Willd.) Cabrera
Gamochaeta purpurea (L.) Cabrera
Gamochaeta standleyi (Steyerm.) Nesom
Gnaphalium attenuatum DC.
Gnaphalium brachyphyllum Greenm.
Gnaphalium brachypterum DC.
Gnaphalium liebmanii var. *monticola* (McVaugh) D. Nash
Gnaphalium salicifolium (Bertol.) Sch. Bip.
Gnaphalium semiaplexicaule DC.
Gnaphalium viscosum Kunth

Helenieae
Bahia depauperata Blake
Dyssodia montana (Benth.) Gray
Pectis prostrata Cav.
Tagetes filifolia Lag.
Tagetes foetidissima DC.
Tagetes sororia Standl. & Steyerm.
Tagetes tenuifolia Cav.

Heliantheae
Acmella brachyglossa Cass.
Acmella papposa (Hemsl.) R. K. Jansen
Acmella repens var *beccabunga* (DC.) R. K. Jansen
Alepidocline annua Blake
Alloispermum integrifolium (DC) H. Rob.
Alloispermum scabrum (Lag.) H. Rob. var. *scabrum*
Bidens aurea (Ait.) Sherff
Bidens bicolor Greenm.
Bidens chiapensis Brandegee
Bidens chrysanthemifolia (Kunth) Sherff

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Bidens holowayi Blake & Sherff
Bidens odorata Cav.
Bidens ostruthioides (DC.) Sch. Bip.
Bidens pilosa L.
Bidens squarrosa Kunth
Bidens triplinervia Kunth
Calea skutchii Blake
Calea ternifolia Kunth var. *ternifolia*
Calyptocarpus wendlandii Sch. Bip.
Clibadium arboreum Donn. Sm.
Coreopsis mutica DC. var *microcephala* Crawford
Cosmos diversifolius Otto
Dahlia australis (Sherff) Sorenson
Dahlia coccinea Cav.
Dahlia imperialis Roezl *ex* Ortgies
Galinsoga ciliata (Raf.) Blake
Heterosperma pinnatum Cav.
Hymenostephium cordatum (Hook. & Arn.) Blake
Hymenostephium guatemalense (B. L. Rob. & Greenm.) Blake
Jaegeria hirta (Lag.) Less.
Jaegeria standleyi (Steyerm.) B. L. Turner
Lagascea helianthifolia Kunth
Lasiathaea fruticosa (L.) K. Becker
Melanthera nivea (L.) Small
Montanoa guatemalensis B. L. Rob. & Greenm.
Montanoa hibiscifolia (Benth.) Sch. Bip.
Montanoa pteropoda Blake
Neurolaena lobata (L.) R. Br.
Neurolaena macrophylla Greenm.
Oteiza ruacophila (Donn. Sm.) Fay
Otopappus brevipes B. L. Rob.
Otopappus verbesinoides Benth.
Perymenium ghiesbreghtii B. L. Rob. & Greenm.
Perymenium grande Hemsl. var. *grande*
Podachaenium eminens (Lag.) Sch. Bip.
Podachaenium skutchii (Blake) H. Rob.on
Polymnia maculata var. *adenotricha* Blake
Polymnia maculata Cav. var *maculata*
Polymnia riparia Kunth
Rojasianthe superba Standl. & Steyerm.
Rumfordia penninervis Blake
Sabazia sarmentosa Less. var. *sarmentosa*

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Salmea scandens (L.) DC.
Schistocarpha platyphylla Greenm.
Schistocarpha seleri Rydb.
Sigesbeckia agrestis Poepp. & Endl.
Sigesbeckia jorullensis Kunth
Simsia amplexicaulis (Cav.) Pers.
Simsia ghiesbreghtii (Gray) Blake
Simsia sericea (Hemsl.) Blake
Tithonia diversifolia (Mill.) Blake
Tithonia longiradiata (Bertol.) Blake
Tithonia tubaeformis (Jacq.) Cass.
Verbesina apleura Blake
Verbesina fraseri Hemsl.
Verbesina guatemalensis B. L. Rob. & Greenm.
Verbesina holowayi B. L. Rob.
Verbesina hypoglauca Sch. Bip. *ex* Klatt
Verbesina sublobata Benth.
Verbesina scabriuscula Blake
Verbesina steyermarkii Standl.
Verbesina turbacensis Kunth
Zexemenia salvinii Hemsl.

Lactuceae
Hieracium abcissum Less.
Hieracium gronovii L.
Hieracium irazuense Benth.
Hieracium schultzii Fries
Hypochoeris glabra L.
Sonchus oleraceus L.
Taraxacum officinale Weber

Liabeae
Liabum bourgeaui Hieron.
Sinclairia discolor Hook. & Arn.
Sinclairia glabra Rydb.
Sinclairia sublobata (B. L. Rob.) Rydb.
Sinclairia vagans (Blake) Rob. & Brett.

Mutiseae
Acourtia carpholepis (Gray) Reveal & King
Acourtia nudicaulis (Gray) B. L. Turner
Chaptalia nutans (L.) Polak

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Jungia guatemalensis Standl. & Steyerm.
Onoseris onoseroides (Kunth) B. L. Rob.
Trixis inula Crantz.

Plucheae
Pluchea odorata (L.) Cass.

Senecioneae
Erechtites hieraciifolius var. *cacalioides* (Fisch. *ex* Spreng.) Griseb.
Erechtites valerianaefolia (Wolf) DC.
Nelsonianthus epiphyticus H. Rob. & Brett.
Pentacalia parasitica (Hemsl.) H. Rob. & Cuatrec.
Pentacalia phorodendoides (L. O. Williams) H. Rob & Cuatrec.
Psacalium pinetorum (Standl. & Steyerm.) Cuatrec.
Roldana acutangula (Bertol.) H. Rob. & Brettell
Roldana aschenborniana (Schauer) H. Rob. & Brettell
Roldana barba-johannis (DC.) H. Rob. & Brettell
Roldana gilgii (Greenm.) H. Rob. & Brettell
Roldana greenmanii H. Rob. & Brettell
Roldana heterogama (Benth.) H. Rob. & Brettell
Roldana jurgensenii (Hemsl.) H. Rob. & Brettell
Roldana petasitis (Sims.) H. Rob. & Brettell
Roldana schaffneri (Sch. Bip. *ex* Klatt) H. Rob. & Brettell
Senecio callosus Sch. Bip.
Senecio doratophyllus Benth.
Senecio godmanii Hemsl.
Senecio oerstedianus Benth. *ex* Oersted.
Senecio phorodendroides L. O. Williams
Senecio warszewiczii A. Br. & Bouche
Werneria nubigena Kunth

Vernonieae
Elephantopus mollis Kunth
Pseudoelephantopus spicatus (Juss. *ex* Aubl.) Rohr
Vernonia deppeana Less.
Vernonia arborescens (L.) Sw.
Vernonia leiocarpa DC.
Vernonia salvinae Hemsl.
Vernonia mima Standl. & Steyerm.
Vernonia shannonii J. M. Coult.
Vernonia tortuosa (L.) Blake

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[1] Reported from the Sierra Chuatroj, by Véliz et al., 2001.